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Rough Notes of an Exploration for an Inter-oceanic Canal Route by way of the Rivers Atrato and San Juan, in New Granada, South America.

By JOHN C. TRAUTWINE, Civ. Eng., Philad.

Continued from page 155.

THE SAN PABLO FROM THE CERTIGUI TO THE CONFLUENCE OF THE RASPADURA AND SANTA MÓNICA, a distance of twenty-one miles.

Approaching the confluence of the Raspadúra and Santa Mónica, the San Pablo has an average width of about 100 feet, but in many places is restricted to 60 feet. The width of the boating channel, however, here becomes reduced to between 10 and 20 feet, with *ordinary* depths of some 3 to 4 feet. Near the Raspadúra, the average depression of the bed of the stream below the average summit of the regular levees, is about 9 to 12 feet. Consequently, the extremes of depth range from this latter limit, as a maximum, down to some 18 inches in the lowest stages, as a minimum. The bed, however, is much worn into pools with deeper water. An old negro, living on the banks of the San Pablo, but a mile above the entrance of the Cértigui, told me that even that far down, he could, at times, in almost every month, wade across with the water not above his middle, in mid-channel.

At a point 4 miles below the Raspadúra, where the fall of the stream appeared regular, I found it to be at the rate of 4 feet to a mile; but at another place, some two miles above the confluence of the Santa Mónica, at which also it appeared to be a fair average, a careful leveling of 300 yards in length gave a descent of 10 feet per mile.

On arriving at the confluence, I wished to ascend the Raspadúra, in preference to the Santa Mónica, inasmuch as the former is the branch by means of which the Cura of Nóvita is said to have connected the waters of the Atlantic with those of the Pacific, in the year 1788, as stated by Humboldt, *on the authority of other persons*. Our peones, however, who were well acquainted with both streams, dissuaded me from the attempt, by assuring me that in the present condition of the water, we could not possibly force our boat up it, although she drew but eight inches. We afterwards found that we had to drag her along portions of even the Santa Mónica.

So far as we could see up a short reach of the Raspadúra, from the place of confluence, it certainly appeared inferior to the Santa Mónica; being more encumbered by fallen trees, and exhibiting a more rapid descent and current. Having been assured, not only at Carthagena, but by old and intelligent persons in Quibdó, that the story of the Curás *Canal* was an exaggeration, I felt the less scruple in yielding to the confirmatory representations of our peones, to whom I had not previously spoken on the subject; having purposely omitted to do so, in order to obtain their unbiassed opinion; and they were too much fatigued when we reached here, to select the more laborious route.

The water of the Raspadúra was very muddy from the gold washing operations that were going on farther up the stream.

We had passed small parties engaged in this occupation, at short intervals, all the way from Quibdó. Gold occurs more abundantly on the Raspadúra, than on the Santa Mónica, in accordance with the general law of increase, in proportion as the streams head nearer to the Cordilleras.

The Andágueda has the reputation, throughout this region, of furnishing greater quantities, and particles of larger size, than any other of the tributaries. It will be seen from the Map, that this stream descends by several ramifications, from the spurs of the very Cordilleras.

The gravel of its bed, especially in the more elevated sections, is represented as being surpassingly rich. Its collection, however, is attended with great labor, in consequence of the precipitous character of the stream. This has washed its bottom into a succession of deep pools, in which the most valuable depositions of the metal occur, but from which they are proportionately hard of extraction.

Dr. Key informed me that some years ago, a diving bell was brought over from England, by some adventurers, to be used in the deep pools of the Andágueda; but for some reason or other, it was never applied to its intended purpose.

At the distance of a few miles above the Cértigui, the River Taridó enters the San Pablo from the west. At its head is an atravesia communicating with the Charidó, a small branch of the Baudó. Similar pathways across the ridge occur at the heads of nearly all the principal tributaries of the Atrato which enter it from the west: inasmuch, as they all have their sources opposite to, and within a few miles of, streams leading to the Pacific. See Map.

From the confluence of the San Pablo and the Raspadúra, to the head of canoe or ranchada navigation, a distance of eight miles, or 281 miles

in all from the mouth of Caño Coquito, or 61 miles above Quibdó, the stream loses the former name, and is called the Santa Mónica.*

This is a mere brook, very serpentine, and fluctuating in its depth almost every few hours. Its bed is much worn into pools, so that in low stages a great portion of its length presents a channel, continually varying from a few inches to two, three, or four feet of water. Near the confluence, its width between the banks generally ranges from 80 to 100 feet, and the depth of its bed below the tops of levees, from 6 to 10 feet; but as we ascend to the head of canoe navigation, these dimensions all become reduced about one-third part. The boating channel, however, usually occupies but a small proportion of the width, frequently, indeed, but two or three yards. By leveling portions of its bed, and removing a great many trees, the Santa Mónica would become well adapted for flat boats; but I should consider any further improvement a waste of money.

The numerous depressions, or rather *interruptions*, of the levees of the Santa Mónica and San Pablo, caused by the entrances of tributaries, or of wide marshy tracts on the same level, appear to me to render hopeless all ideas of improvement in the depth of those streams by any process of embankments, either with or without accessory locks and dams. Frequently, portions of even the natural levees are precipitated into the river by the combined action of undermining, and of hydrostatic pressure of the back-water attendant on the rapid subsidence of the streams after an overflowing freshet.

When we descended the Santa Mónica, in a flood stage, a boat drawing three, or perhaps even four feet, could have navigated it in safety, notwithstanding the great number of trees which cover its bed. But in ascending it now, the trees, for a few miles in the upper part, gave us a great deal of trouble; and the water being in many places but 5 or 6 inches deep, we had to get out and drag our boat for considerable distances at a time. The peones had occasionally even to scoop away the gravel with their hands in advance, to enable us to force her along.

After a few hours of this species of navigation, they became completely exhausted, and could proceed no farther; so that at 2 o'clock, P. M., we were compelled to stop for the day, at a negro hut, less than half a mile below our intended place of disembarkation. Had I known we were so near it, we should have shouldered our baggage, and navigated on foot; but the peones felt a delicacy in informing me of the fact, lest I should insist upon taking the boat along.

We had the comforting assurance, however, of experience, that we should not have to wait long for rain enough to allow us to proceed; and, accordingly, as evening closed in, it came down in true tropical style. Although it slacked off considerably before morning, it still left us some three feet of water, so that by sunrise we were at the "tambo."

This word, strictly interpreted, means a tavern; but throughout Span-

*The most erroneous map of the Atrato that I have seen, is one recently published by a Member of the Royal Geographical Society of London. In it, the Atrato is said to be laid down from recent observations by the Chief Engineer of the New Granadian Government. My own protractions confirm the superior accuracy of Col. Acosta's representation of that river, to a remarkable degree; proving that neither he nor I can be *much* in error, although I was far from aiming at *scrupulous* accuracy in my survey of it.

ish America, so called, it applies to any building erected at an embarcadéro, or place of embarkation. All such erections necessarily partake, more or less, of the character of places of public entertainment, even though they afford entertainment of no kind whatever; or, (as in the case of that at the western end of the atravesia from the Pató to the Baudó,) cannot as much as boast of a regular tenant.

This, however, which is called the Tambo de San Pablo, or of St. Paul, has a tenant, and serves as a receptacle for the accumulation of goods and produce while waiting either for bipedal beasts of burden to transport them on their backs across the atravesia or crossing place, to San Pablo; or for boats, or water sufficient to carry them down the stream.

Here we were told that the Santa Mónica became as reduced as it was yesterday, (that is, to a few inches,) in nearly every month of the year; and that in the Veranillo de San Juan, it in many places presented a channel but 3 or 4 feet wide, and 3 or 4 inches deep.

Even up to this point, the immediate banks were levees, a little higher than the ground back of them.

As we reached here on Sunday morning, we at first determined to make it a day of rest, prior to commencing our measurements and levels across the atravesia to the San Juan, on the next morning. But finding, after an hour's sojourn, that the character of the individuals just then congregated there, was not such as to invite overtures towards a cordial fraternization, we concluded to walk over to San Pablo, which is, by our measurement, but three and three-quarter miles distant by the path; or three and a quarter in a straight line. Short as this distance is, yet when the pathway happened to be very muddy, immediately after a heavy rain, it sufficed for an extremely fatiguing walk. We were, in several places, compelled, while in a state of profuse perspiration, to enter water three feet deep; and for a great portion of the distance to trudge through stiff mud, reaching to near the tops of our boots, and clogging them with some pounds of extra weight. Once we were full two hours and a half in crossing. It is true, poles and small squared timbers are laid along parallel to the path for much of the way, ostensibly for the convenience of travelers; but they are usually so narrow and slippery, that I rarely availed myself of them. Yet this is the most traveled road or pathway in this region.

Preparatory to setting off, I ascended the stream for a few hundred yards from the tambo, to bathe. While enjoying this luxury, I was somewhat startled for an instant, by the sudden apparition of a venerable, grave-looking, white-haired, negro woman, who came wading slowly down the creek, holding a small totuma, or calabash bowl, carefully in her hands. In the surprise of the moment, I might have mistaken her for a respectable old baboon, taking a morning stroll, with a cocoa nut in its paws, had it not instantly occurred to me that that animal, with all its sagacity, had not yet adopted the practice of wearing diapers, or smoking segars.

After an exchange of salutations, I approached her in as delicate a manner as the peculiar circumstances of the case permitted; and, with more curiosity than politeness, begged permission to inspect the contents

of the totuma. She consented; and I found it to be a small quantity of gold dust which she had just collected from the bed of the stream.

Nearly the whole surface of the country is covered by a thick layer of the gold and platina bearing diluvium. Even the hill of Barro Blanco, (or white mud,) which is the highest ground between the Tambo and San Pablo, rising 144 feet above the former, and 247 feet above the latter, (See the "Route of the line of Levels" on the Map,) appears to consist exclusively of it; and there is not a single stream from the bed of which these metals may not be extracted. I conscientiously believe, from all I could learn of the richness of this strip of country, that were it in the United States, the gold that might be collected from the necessary excavations, would defray the entire cost of a first class railroad. This may appear to many to be the language of exaggeration; but I can assure the reader that it conveys my sincere convictions.

I will even tax his credulity still further, by asserting that gold dust is *actually daily collected*, (almost indiscriminately as regards details of locality,) over an area of *at least* some two thousand square miles of the Western slopes of the Western Cordilleras; while the exportation of it from the Eastern slopes of the same range, annually amounts to some millions of dollars, even now.

In many places, the banks of the streams exhibited layers of semi-bituminized leaves and branches in contact with the gold gravel; in some cases above, and in others, either below it, or alternating with it.

It is not the Atrato and San Juan alone, that penetrate to the El Dorado of New Granada. The Great Magdalena, and its equally great tributary the Cáuca, "roll down their golden sands" from the same inexhaustible repository of nature's treasures.

In the valleys of these streams some few rude attempts have been made at mining the gold and silver *veins* in a somewhat systematic manner; and the exports of gold from them annually, amounts to some three or four millions of dollars. It goes chiefly to France and England.

The hill of Barro Blanco is a singular isolated elevation, half a mile long, and but from three to five yards wide on top, and with steep sides, covered thickly with trees and undergrowth. In conformity with the "costumbre del pais," the pathway is carried over the entire length of the summit of this hill, instead of following the depressions that present themselves at the distance of but a few rods on either side of it, and apparently 60 feet lower, as nearly as we could judge by eye.

This circumstance, by the bye, reminds me that in speaking of the atravesia from the head of the Pató to the Baudó, I accidentally left it as a matter of inference, instead of making it one of direct assertion, that that pathway also was traced upon the same principle; and that ground some 200 feet lower appeared to us, at the time, to have been attainable for crossing the summit.

The peculiar configuration of the hill of Barro Blanco, is not confined exclusively to *it*, but characterizes several of the other short ranges shown on my map.

It will be observed, on referring to the "Route of Levels" attached to the map, that the waters of the Santa Mónica, and of the Creek of Citará, head close together. At this point, however, they are mere trick-

ling runs when there is no rain; although they afford from one to three feet of water during, or for a few hours after heavy falls.

Now, it is not only possible, but even quite probable, that a Cura, interested in the boating business, may have exercised sufficient influence over some of the gold hunting members of his flock, in the immediate vicinity of the spot, to induce them to cut down a few bushes, and hollow out a short gutter between some two similarly situated little runs on top of the ridge near the head of the Raspadúra; and such a ditch may have been used as part of a canoe-slide across the intervening eminence, until filled up again by the rain washes. That nothing more *was* done, is evident from Humboldt's remark that "when the rains are *abundant*, *canoes* loaded with cacao pass from sea to sea."

Precisely the same kind of canal could now be made by a dozen expert laborers, in a few days. But if done, it would be difficult to command the energy required to keep it open. A few months' rain would fill it with gravel; the people would shrug their shoulders, and pronounce it a case of "Dios lo quiere," (God wills it;) and the peones rejoicing in the failure of the innovation, would again strap their heavy burdens to their foreheads, and trudge along contented, according to the "costumbre del pais."

I was at San Pablo in 1852, or but 64 years after the date given to Humboldt as that at which the Cura's canal was dug; yet persons living near the spot, both before and ever since that period, told me they had never heard of it; nor did I meet with one, out of more than 50 persons familiar with the Raspadúra locality whom I interrogated on the subject, that had. This is not to be construed into a proof that no ditch was dug; but merely that it was a work of such entire insignificance as to create little or no impression even in a region where internal improvements are entirely unknown.

All, however, confirmed the statements made by my friends in Quibdó, and by my Indian peones, and supported by what very little I saw of the Raspadúra near its mouth, that that stream was both more rapid and more shallow than the Santa Mónica; and that the atravesia between its head waters and those of the little Quebráda leading to the San Juan, was higher than that across which I ran my line of levels. The best evidence of this fact, however, is afforded by the circumstance that the Raspadúra route has, for many years, been entirely superseded by that of the Santa Mónica, for both travel and transport.

The town of San Pablo contains about thirty houses or huts, one story in height, built chiefly of palm strips. Many of them are raised on stilts to avoid the freshets of the San Juan. Through the courtesy of Señor Abadia, one of the principal men of the place, we were accommodated with one belonging to him, and joining his own. Through the crevices between the rough palm strips of the partitions, we could see and hear, or rather, could not avoid seeing and hearing, all that transpired in the houses of our neighbors on both sides.

Our previous tropical experience, however, had thoroughly inured us to such things; and we could, consequently, dress and undress with the most stoical indifference, under a battery of a dozen brilliant black eyes manœuvred by inquisitive señoras and señoritas, equally black.

Our baggage boxes served for chairs and tables; and our meals were prepared for us, and sent to our house by a señora store-keeper, with whom we had made an arrangement for that purpose. They were, however, generally handed over to our peones, as from the style of cooking, we found it impossible to eat them, so long as we had a reserve of sardines and crackers to fall back on.

In most of the houses small shops are kept, the scanty supplies of which, are chiefly brought from Carthagena, by way of Quibdó.

While the Pacific lines of British steamers touched at Buena Ventura, some little commercial intercourse was maintained between that point and San Pablo, by way of the San Juan. This, however, has now ceased, and the gold dust and platina, collected in the vicinity of San Pablo, now find their way chiefly to Carthagena, and thence to Europe and the United States, in payment of imported goods.

The collection of these metals employs, more or less directly, nearly all the inhabitants of San Pablo and the adjacent region.

The town stands on the east side of a small creek, about 100 feet wide, called the Quebrada of Citará, which here fluctuates generally between one and five feet in depth, depending on the duration of the constantly recurring showers. Every year there occur high freshets, which give it a depth of twelve or fourteen feet, rising to near the floors of the houses. Señor Abadia told us that about thirty years ago, a flood in the San Juan, aided by a simultaneous one in the Quebráda, raised the waters of the latter more than 20 feet above its bed, covering the floors of the houses to a depth of four or five feet.

On the opposite side of the creek is a hill, apparently nearly a hundred yards high.

Dr. Halsted made the latitude of San Pablo five degrees nine minutes north; his opportunity lasted for but a quarter of an hour; sufficing only for a single observation, and even it, he thought, might be in error some two or three minutes. I had no chance to observe for myself.

We were not at all annoyed by mosquitoes while at San Pablo; and but little by hejenes, (or gnats.) Very few birds were seen in the neighborhood; nor did we encounter a single wild quadruped, or a snake of any kind, although we passed and re-passed between San Pablo and the Santa Mónica several times.

The town itself appeared to be somewhat infested by a few of that loafing class, who regard time only as an essential element in smoking and lounging; and who, having no business of their own to attend to, intrude themselves into that of others.

About a dozen of the most confirmed of these nuisances, some with and some without shirts, and of all ages and sizes, selected our room, doorway, and window, as their stand, as soon as we had installed ourselves; and here they maintained their position from morning till night, during our entire stay, except when a shower would scatter them for a while. Although their visits were intended rather as complimentary than otherwise, we should have considered the custom much "more honored in the breach than in the observance."

We found the price of provisions to be very high here; plantains were selling at two cents a-piece; shelled corn for bollo (a kind of corn bread,

or more properly, a kind of corn putty,) at fifty cents an almoud (about twenty five pounds;) and other articles in proportion.

Such river floods as overtop the levees, frequently overthrow and destroy the crops of corn, and some other kinds of produce, not only along the San Juan, but also the Atrato, Baudó, &c.

There is no church in San Pablo, which is the only Granadian town I ever saw without one. The sabbath is here, as in all Catholic countries, devoted not only to religious observances, but also to recreation, visits, and amusements of every kind.

At San Pablo it is more especially marked by the arrivals of canoes loaded with produce from the negro ranchos along the levees of the San Juan. The proprietors of these usually avail themselves of the occasion to treat the females of their families with a shopping visit to the town; while they themselves engage in the nobler pursuits of drinking and cock-fighting. Although the stock of most of the shops comprises little more than half a dozen bottles of mata burro, a few handfulls of segars, and some three or four yards of coarse gaudy cotton handkerchiefs, yet some contain very fair assortments of such cheap crockery, dry goods, hardware, and groceries, as are in demand hereabouts.

Our line of levels (see Map) showed that the bed, or bottom, of the San Juan at San Pablo, was 103 feet below that of the Santa Mónica at the Tambo of San Pablo, or head of canoe navigation; and that the lowest intervening ground at the summit between the two is *about* 183 feet above the former, or 80 feet above the latter. I say *about*, in reference to the height of the summit, because our levels were actually taken along the pathway over the hill of Barro Blanco; and the depth of the depressions at the side of the hill was merely estimated by eye, inasmuch as its exact determination was a matter of no importance whatever in view of the great question at issue.

The highest point attained by the pathway over the summit of the hill itself, is 144 feet above the Santa Mónica, and 247 above the San Juan; and the depression at its side, where the sources of the two Quebrádas approach nearest together, appeared to be *about* 64 feet below the summit; which would make it *about* 80 feet above the Santa Mónica.

The width of the San Juan at San Pablo, we found to be 450 feet. The depth, at the time we sounded it, was just five feet for nearly the entire distance across; and the current in mid-channel, was three miles per hour.* The adjacent banks were from four to nine feet above the then stage of water, making the depression of the bed itself from 9 to 14 feet below the tops of the banks. This was almost precisely the same depth that we had found at the time of our first visit.

Sometimes, however, it becomes so reduced, that boys can readily wade across the river, as they do across the Atrato at Quibdó; while, on the other hand, in high floods, it overtops its levees some two or three feet, and inundates large tracts of back lands. This occurs every year, and generally, several times a year. From all I could learn, the *ordinary* depth in mid-channel at San Pablo, may be considered as ranging between five, and seven or eight feet.

* I suspect, however, that the velocity here would have been greater, had not a shoal existed a short distance below.

J. C. T. del. Thomas & Co's Steam lith. press. Phila.

SAN PABLO FROM EAST BANK OF SAN JUAN.

The bed of the river above, and for some leagues below the town, consists of large rounded paving pebbles of sienite, porphyry, and other primary rocks.

The reader is now possessed of the most prominent facts bearing upon this locality in reference to the construction of a canal.

To even the least initiated in engineering science, it must be self-evident that the idea of a ship canal cannot be entertained for a moment; while those better qualified to form an opinion on the subject, will, I doubt not, coincide with me in the assertion that the expenditure necessary to consummate a canal for steamboats of but six feet draft, could not be justified by any remunerating intercourse that could be anticipated between the two oceans by this route.

After the mineral riches of this region shall have gradually drawn together a new population of hardy and enterprising foreigners, (and this period, I venture to predict, is not very far distant,) then the necessity for a more regular medium of transport along the upper waters of the Atrato, and across the dividing grounds between them and the San Juan, will force itself upon those pioneers. Then we may expect that slight improvements, such as will afford an uninterrupted navigation of the streams by boats of some 18 inches, or two feet draft; and short connecting roads transitable by horses and wagons, (or by the loaded boats themselves, placed on wheels,) will be made. But to look beyond this period, demands the gift of prophetic inspiration.

It is to be regretted that, of the various representations that have been submitted to the public, as to the feasibility of the several inter-oceanic canal routes through this region, none have emanated from practical civil engineers. The authors of most of them, apparently, shelter themselves in the shadow of the illustrious Humboldt, and discard the evidence of their own senses, in favor of mistatements, however gross, innocently promulgated by that truly great man. Humboldt never visited any of these proposed routes, and is, therefore, no more qualified than any other person to advance arguments respecting them, requiring a personal acquaintance; nor has he pretended to do so.

I yield to none in veneration for the august name of Humboldt; but I must beg leave to enter my protest against the silly parade of it as authority, in cases in which he himself distinctly disavows all pretensions as such. The fact is, that his informants, as well as those of more recent date, have, either wilfully or through ignorance, slurred over difficulties, which, in the ordinary sense of the word, may be pronounced insurmountable. As a rule of almost universal application, the superficial observations of unprofessional travelers, have led to the propagation of erroneous ideas on all similar cases pertaining to the province of the Civil Engineer.

Among the principal difficulties to be encountered in the construction of even a canal for small boats, of say 3 feet draft, is, first, that the San Juan is 103 feet below the head of canoe navigation on the Santa Mónica; and that the lowest depression in the dividing ridge between the two streams is *about* 183 feet above the former, and *about* 80 feet above the latter. We therefore should have (on the most economical mode of proceeding,) 103 feet of lockage; in connexion with a long cut of some 80

or 90 feet in depth at the centre; and a reservoir for supplying the summit level.

Besides these, the Santa Mónica would require a good deal of improvement, as before hinted; as would also the upper portions of the San Pablo, before they would be available for a tolerably regular system of navigation by boats of even 3 feet draft.

Second;—The entire year may be regarded, practically, as one continuous rainy season. On this account, it would be altogether impossible to assign any limit to the period that would be required for the execution of the work; or to frame even an approximate estimate of its cost. Numberless secondary inconveniences attendant on this source will suggest themselves to an experienced engineer; especially those of sickness, and the impassable condition of the soil for vehicles employed in transporting stone, timber, &c., for construction.

It is well known that on the Panama railroad, the rainy season compels a comparative suspension of operations for nearly half the year; and the rains at the site of our canal, are fully as heavy as on the Isthmus of Panama; beside extending through the whole year. We also know that we may safely state the cost of the Panama railroad at not less than about five times as great as if it had been in the United States: and if we assume but the same proportion for our small boat canal, we shall arrive at an expenditure of about five millions of dollars.

The interest on this sum, in addition to the expense of annual repairs, lock-tenders, agents, &c., would equal, in amount, the entire value of all the merchandize that would probably pass through the canal in any one year for a long time to come; and consequently could not be repaid by any system of tolls that would be submitted to.

I cannot imagine that such a canal would ever form a highway *between the two oceans* for any travel or freight, beyond, perhaps, the persons and baggage of some few individuals, whom curiosity might prompt to select that route in preference to the Panama Railroad.

That road is, in my opinion, destined to remain for a long time the sole medium of ready transport between the Atlantic and Pacific.

From my description of the depths of the rivers on both sides of San Pablo, it is evident that a canal for steamboats of some six or seven feet draft, would be immensely more expensive than the small one which I have supposed, inasmuch as it would involve an extensive system of river improvements, the cost of which I cannot (under all the peculiar incidental difficulties of the case) pretend to estimate; nor, indeed, do I believe it to be susceptible of computation.

The result of my levels across the Isthmus of San Pablo having acted as a final extinguisher to my hopes of an inter-oceanic canal; I determined not to return to Quibdó after I should have explored the San Juan to the Pacific, as had been my intention hitherto; but from the mouth of that river to find my way back to the United States by way of Panama, as best I could. I therefore dropped a line to Mr. McCann, who was still in Quibdó, and requested him to return to Carthagena, and await me there. Our Patron and peones were not apprized of the change, lest they might decline to accompany us down the San Juan if they knew of it.

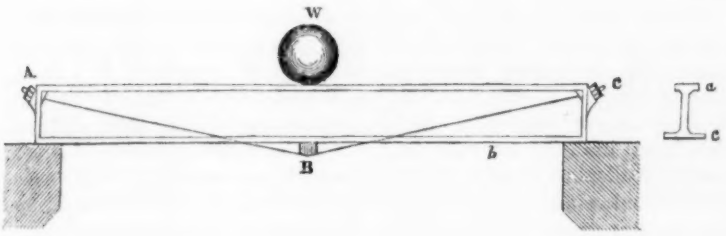
(To be Continued.)

*On Compound or Trussed Cast Iron Beams or Girders.** By W. Fairbairn, C. E., F. R. S. &c., &c.†

In a Government Report several important facts were recorded, bearing directly upon the dangerous nature of trussed girders, or that description of girders where attempts are made to increase their strength, and to maintain them in form, by the use of wrought iron bars fastened at the upper ends, and acting in a diagonal direction on the bottom of the beam. Of the safety of these tension-rods I have always had serious apprehensions; but as many other persons, of highly distinguished attainments, hold a different opinion, it may not be considered irrelevant if I adduce my reasons for the view which I take, and the experiments upon which those reasons are founded.

If we take a cast iron beam of the section of greatest strength, and endeavor, by means of truss-rods, similar to A B C in the following sketch, to increase its powers of resistance, we shall find that under certain circumstances, they introduce an antagonistic force, which has an injurious influence; or that, in other words, the beam would be safer without the truss-rods than with them.

To some, this may appear paradoxical; but in order to ascertain how far the statement is entitled to credit, let us assume the flanches, *a*, *a*, fig. 1, to be one-sixth of the area of the flanch, *b*, *b*;‡ and under the



impression of still further adding to its strength, let us suppose that two truss-rods, A, B, B, C, are applied one on each side of the beam, to assist in supporting the weight w.

Experimentalists having found that wrought iron possesses great powers of resistance to extension, while cast iron presents great powers of resistance to compression, it became a matter of inquiry how far, and under what circumstances, cast iron and wrought iron might be employed together in the construction of beams, so as to embrace the advantages arising from these peculiar properties of the two materials. This inquiry gave rise to the construction of truss-beams, where the

* "*On the Application of Cast and Wrought Iron to Building Purposes.* By W. Fairbairn, C. E., F. R. S., &c., &c. London: J. Weale, 1854.

† From the London Artizan, March 1854.

‡ These proportions are found by experiment to constitute the strongest sectional form. See Mr. Hodgkinson's Experiments, *Manchester Memoirs*, Vol. v., Second Series.

wrought iron is solely employed to give strength to the bottom part of the beams by its tensile resistance, while the cast iron in the top part of the beams is solely employed to resist the force of compression. Now, if a truss-beam could be constructed so that the two materials might be brought to act in perfect concert with each other, this contrivance would, no doubt, effect a considerable economy of material; but we shall hereafter show that this is impracticable.

In a perfect truss-beam (supposing it possible to have such a thing) the cast metal should be upon the point of rupture at the same moment that the truss-rods are about to yield to extension. If too great a tension is given to the rods, they will break before the beam has arrived at the condition of rupture; on the contrary, if too small a tension is given to them, the beam will break before they have arrived at their condition of rupture. In absence of exact data, we should say, in order to avoid danger, that the tension of the truss-rods had better be too low than too high; for in the former case they would yield up a portion of their tensile resistance, and then leave the remaining portion of the load to be borne by the beam itself. Experiment I., shows the difficulty of adjusting the tension of the truss-rods; for in this case they yielded to extension, and and then the beam broke with a weight which it would have nearly sustained by its own resisting powers. In order to discover the best tension for truss-rods, it is necessary that we should consider more minutely the distinctive properties of the two metals composing the truss-beam.

The two kinds of material are very different in their physical as well as in their mechanical properties. *Cast iron* is a hard, rigid, crystalline, unmalleable substance, which presents a great resistance to a force of compression, but a comparatively small resistance to that of extension; and from its low degree of ductility, it undergoes but little elongation when acted upon by a tensile force. On the contrary, *wrought iron* is a flexible, malleable, ductile substance, which presents a great resistance to a force of extension, but a somewhat less resistance to that of compression: from its high degree of ductility, it undergoes a considerable elongation when acted upon by a tensile force. When the two metals are released from the action of the tensile force, the SET of the one metal differs widely from the SET of the other. The flexibility of wrought iron is from eight to ten times greater than that of cast iron. Under the same increase of temperature the expansion of wrought iron is considerably greater than that of cast iron. While wrought iron yields to a stroke, cast iron is readily broken by a severe collision, or by any violent vibratory action.

The following generalizations of an extensive series of experiments will give an exact comparative view of these properties of cast iron and wrought iron:

TABLE I.—*Mean elongations by tensile forces within the limits requisite to rupture cast iron, viz: about 7½ tons per square inch of the transverse section.*

Name of the metal.	Mean elongation, the force being 1 ton per square inch.	Proportion of elongation.	Sets with 7 tons per square inch.
Cast iron,	$\frac{1}{545}$ part of the whole length of the bar, . . .	$2\frac{1}{4} : 1$	$\frac{1}{7}$ of the whole elongation.
Wrought iron,	$\frac{1}{1230}$ part of the whole length of the bar, . . .		$\frac{1}{11\frac{1}{2}}$ of the whole elongation.

From this table it appears, that for forces of extension below $7\frac{1}{2}$ tons per square inch, the mean elongation of cast iron is about $2\frac{1}{4}$ times that of wrought iron. When the cast iron is about to undergo rupture, its ultimate extension is about 3 times that of the wrought iron. Moreover, the set of the cast iron, within this limit, is considerably greater than that of the wrought iron.

TABLE II.—*Mean elongations and sets, with tensile forces equal to two-thirds of the forces requisite to produce rupture in each case respectively.*

Name of the metal.	Force per sq. in. in tons.	Elongation on 10 feet of the bar, in inches.	Proportions of elongations.	Set.	Proportions of sets.	Proportions of sets to elongation.
Cast iron,	5	·114	$1 : 2\frac{2}{5}$	·013	1 : 10	$\frac{1}{9}$
Wrought iron,	15	·275		·133		$\frac{1}{2}$

From this table it appears, that when the parts of the truss-beam are duly loaded, the conditions are reversed; that is to say, the elongation of the wrought iron becomes $2\frac{2}{5}$ times that of the cast iron, and the set of the former becomes 10 times that of the latter.

TABLE III.—*Mean values of the tensile forces requisite for producing equal elongations in cast iron and wrought iron bars 10 feet long, with the corresponding sets.*

Mean elongations on 10 feet in inches.	Cast iron. Force per sq. in. in tons.	Wrought iron. Force per sq. in. in tons.	Cast iron. Set in inches.	Wrought iron. Set in inches.
·005	·26	·56		
·024	1·11	2·5	·0012	Not perceptible.
·040	2·	4·5	·0031	·0005
·050	2·5	5·6	·0043	·0007
·062	3·	6·76	·0056	·0009
·087	4·	9·	·0090	·0027
·129	5·5	12·4	·0159	·0140
·145	5·9	13·26	·0190	·0430

This table establishes the following remarkable law relative to the forces requisite for producing equal elongations in cast iron and wrought iron bars. Within the limit of 6 tons tensile strain per square inch for cast iron, and $13\frac{1}{2}$ tons for wrought iron, the tensile force applied to wrought iron must be $2\frac{1}{4}$ times the tensile force applied to cast iron, in order to produce equal elongations.

(To be Continued.)

AMERICAN PATENTS.

List of American Patents which issued from July 11th, to Aug. 1st, 1854, (inclusive,) with Exemplifications by CHARLES M. KELLER, *late Chief Examiner of Patents in the U. S. Patent Office.*

JULY 11.

81. For an *Improvement in Machines for Carving Marble, Stone, &c.;* William J. Casselman, Assignor to Elias A. Swan, Vernon, New York.

Claim.—"1st, I claim the means for carving or cutting marble or other material, consisting of the adjustable or movable blocks or patterns on a revolving wheel or wheels, for determining the position of the cutting tool or tools, either horizontally or vertically, in combination with a revolving or reciprocating bed. 2d, Communicating motion from a pattern wheel or wheels, constructed with movable or adjustable patterns, both on the circumference and on the sides, to the sliding tool or tools, by means of levers so set and operating as to place said tools in the required position as the parts move, as specified. 3d, I claim constructing a cutting tool or tools for carving marble or similar substances, with blades or tools attached to the bottom and side of the stock, which stock is so fitted as to receive a rotary motion, to operate as specified."

82. For an *Improvement in Machines for Pegging Boots and Shoes;* A. C. Gallahue, City of New York.

Claim.—"I do not claim the employment or use of the rocking bed plate, when such bed plate is attached to a movable carriage, as described, for the purpose of causing the edge of the sole of the boot or shoe to bear against the gauge block as the carriage is moved, without the intervention of a pattern or cam."

83. For a *Machine for Making the Heads of Shovel Handles;* R. D. Bartlett, Bangor, Maine.

Claim.—"I claim to so construct the dished wheel and its cutters, and apply them together, in combination with so constructing the bearing rest with a shelf and bearer plate, or equivalent contrivance, and applying it to the wheel, so as to cause it to extend within the wheel, and enable a person to introduce the shovel head into it, and between it and the inner surface of the wheel, and support said shovel head and turn it against the cutters, so as to cut it curved in two directions."

84. For an *Improvement in Lanterns;* Andrew Lanergan, Boston, Massachusetts.

Claim.—"I claim the combining with the lantern, the mouth tube, so as to enable a person to put out the flame of the lamp."

85. For an *Improvement in Construction of Iron Houses;* C. Mettam, City of N. Y.

Claim.—"I claim the combination of the chairs with the breast summers and the columns, substantially in the manner set forth."

86. For an *Improved Grapnel for Raising Sunken Vessels;* J. T. Martin, City of N. Y.

Claim.—"I claim the combination of the plates, levers, and iron bars, with the timber, constructed to form a marine grapnel to be used in the raising of sunken vessels."

87. For an *Improved Mode of Constructing Metallic Roofing;* Henry Outcall, Wilmington, Ohio.

Claim.—"I claim scrolling the edges of metallic plates, so as to form a tube or cylinder, and then connecting their edges by means of other scrolls, which are formed also into tubes on the edges of a narrow strip of the same kind of plate, and being somewhat larger than the former tube or scroll, so that they will slide over and fit snugly to it for subserving three different purposes, viz: first, for protecting the roof against injury from contraction and expansion; second, for preventing the water from driving through the roofing at the scrolls; third, for supporting the roof and all superfluous weight that may accumulate, such as snow, &c., without any superstructure other than those on which its end rests."

88. For *Improved Arrangement of Means for Freeing Canal Boats from Water;* W. Loughridge, Weverton, Maryland.

Claim.—"I claim the arrangement of float, valve, and bent tube in the bottom of the boat, by which the discharge of water is rendered automatic, and the boat freed from leakage."

89. For an *Improvement in Operating Cut-off Valves of Steam Engines;* Wm. Lowe, Hartford, Connecticut.

Claim.—"I claim the double rock shaft, one passing through the other, the outer shaft to work the catches and exhaust valves, and the inner shaft actuated by the catches to open and close the valves to effect the cutting off the steam, in combination with the other parts of the mechanical movements, or their equivalents."

90. For *Elevated Ovens;* James C. Kennedy, Albany, New York.

Claim.—"I claim the combination of two or more ovens in the elevated oven chamber or shell, with flues for hot air between each end of the chamber and one of the ovens; also, with a flue between each oven, all the flues being provided with regulating dampers for the proper management of said oven and flues."

91. For an *Improved Impact Water Wheel;* Abel Greenleaf, Kingston, Penna.

Claim.—"I claim the combination of the horizontal buckets with the vertical buckets, substantially in the manner described."

92. For an *Improvement in Apparatus for Sealing Cans;* Joel Green, Cincinnati, O.

Claim.—"I claim, 1st, The application of a steam jacket, coil, or equivalent device, to an exhausted receiver, in connexion with soldering apparatus, for the purpose of sealing or soldering preserving canisters, &c., under the combined agencies of heat and vacuum, for the purposes explained. 2d, The combined ball, and sliding and air-tight joint of the rod, as described, permitting the heating, insertion, and the vibratory longitudinal and revolving motion of the soldering bit, while excluding the external atmosphere, for the purpose of soldering in vacuo, as explained, and enabling the direct application of the heated bit, without the intervention of any other substance."

93. For an *Improvement in Lifting Jacks;* R. W. Genung, Blooming Grove, N. York.

Claim.—"I claim making the lever capable of being adjusted so as to be thrown in and out of contact with the rack bar with facility and ease, and retaining it securely in its place after being adjusted, by providing the bearings with a curved slot and two semi-circular fulcrum rests."

94. For an *Improvement in Oil or Blubber Presses;* Wm. P. Chadwick, Edgartown, Massachusetts.

Claim.—"I claim the arrangement of the screw within the body of the box, in connexion with fixing it firmly and immovably to the platen, and so applying to it and one end or the bottom of the box, as described, a rotary screw nut and a set of gears and a crank shaft, that by revolution of the screw nut the platen will be forced towards the top, or other end of the box, the said arrangement and application of the power that operates the platen enabling me to make a much more compact, efficient, and desirable blubber press for ships' use, than that heretofore patented by me."

95. For an *Improved Valvular Arrangement for Diaphragm Pumps;* Stillman A. Clemens, Springfield, Massachusetts.

Claim.—"I claim the mode of constructing and operating the valve, in combination with flexible diaphragms, to wit: the valvular openings being in the diaphragm itself, or in a part of the diaphragm, and the valve being attached to and worked by the piston in such manner that the diaphragm shall move to and from the fixed valve, and close and open the holes in the diaphragm valve."

96. For an *Improvement in Machines for Stretching Shoes;* A Burwell, Rochester, N. Y.

Claim.—"I claim the construction and use of lasts to be operated by two independent screws, in such a manner as to be able to stretch the shoe or boot at the instep or toe, at pleasure. Also, the expanding plates with their projecting pieces of metal applied, operated by the wedge or cone pointed screw."

97. For an *Improvement in Hat Shapers;* Adolph and Felix Brown, City of N. York.

Claim.—"We claim the application of the movable pieces with their set screws working in a groove made in the segments, or the equivalent thereof, and bearing against any desirable point of a flexible plate fitted round the outside, giving, thereby, the same any desirable shape."

98. For an *Improvement in Lifting Jacks;* F. B. Smith, Craigsville, New York.

Claim.—"I do not claim the oblong slot, separately, for the purpose of allowing the lever to be adjusted so as to let the bar fall; but I claim the curved oblong slots, in combination with the double-acting pawl and tooth on the lever, so that the lever may be adjusted, and after being adjusted, prevented from again falling and coming in contact with the rack bar, before it has entirely descended."

99. For an *Improvement in Taking Daguerreotypes for Stereoscopes;* Albert S. Southworth and Josiah J. Hawes, Boston, Massachusetts.

Claim.—"We claim the within described method of taking stereoscopic pictures, in which the two positions of the camera are upon a line, making an angle of 45° with the horizon."

100. For an *Improvement in Bedstead Fastenings;* R. H. St. John, Columbus, Ohio.

Claim.—"I claim the clevis clamp, together with the double mortise post, in combination with the key or wedge, through all of which is produced a compensating bedstead fastening."

101. For an *Improved Chain Hook;* Willis Straw, Dalton, New Hampshire.

Claim.—"I claim the 'iron guard,' and the manner of attaching it to the hook."

102. For an *Improved Mode of Ringing Bells by Steam;* G. B. Snow, Buffalo, N. Y.

Claim.—"I claim the manner described of ringing the bell by the application of steam power, and the gravity and momentum of the bell combined by means of the direct acting engine, attached by a chain, or other equivalent mechanical device, to the bell, and arranged, combined, and operating with the bell, as specified, and so that the bell is swung in one direction by the engine, and then set loose or free to swing back in the opposite direction by its own gravity and momentum, to produce the ring or sound, and the steam alternately admitted to and exhausted from the engine by the action of the engine and movement of the bell combined, substantially as specified, and whereby the same freedom in the swing of the bell to produce a long and clear sound, as is produced by the ordinary manual process, but with greater regularity and consequent increased clearness of note, is automatically obtained."

103. For an *Improvement in Screw Wrenches;* Jabez C. Terry, Springfield, Mass.

Claim.—"I claim attaching the shank of the inner and stationary jaw to the handle, by means of straps, or their equivalents, attached to the lower end of said shank, said straps passing through the screw nut and into the handle, and having grooves or recesses in them, which, when the straps or handle are turned, receive projections on the top of the handle."

104. For an *Improvement in Mills for Grinding;* T. B. Woodward, Kingston, Penna.

Claim.—"I claim the combination and arrangement of one or more cylindrical bruising or grinding nuts and chambers or cylinders with the stones of the mill, in such manner that the relative distance of the stones to each other may be varied without increasing or diminishing the distance of the acting surfaces of the nuts and cylinders."

105. For an *Improvement in Brakes for Light Vehicles;* M. D. Wells, Morgantown, Va.

Claim.—"I do not claim the employment of spiral or other springs to draw the rubbers to the wheel; nor do I claim any of the devices embraced in the patent of Elijah Chapman, September 26, 1846, or the rejected applications of G. Newcomer and J. M. Ewing; but what I claim is, the combination of the two systems of springs, and with the rods and levers, for so operating the brake bar that the movement of the levers, within certain limits, shall have no action on said bar."

106. For an *Improved Mode of Manufacturing Iron Slats for Window Blinds;* Wm. E. Ward, Port Chester, New York.

Claim.—"I claim the manufacture of Venetian blind slats made of sheet iron, of two thicknesses in one piece, with both edges bent entirely over, the two halves of the width

bent or curved in opposite directions, and with a semi-circular head on each face, inclosing a wire, the ends of which form journals."

107. For an *Improvement in Flouring and Bolting;* John Stouffer, Peter Brough, and John W. Barr, Chambersburg, Pennsylvania.

Claim.—"We claim the arrangement of the bolts and pipes, screw conveyor, and spout, by means of which the specky flour, first passing through the upper bolt, is rebolted by being mixed with the stuffs (containing the bran,) as received from the main burrs, by which the quantity of superfine flour is increased, while the quality or brand is maintained, substantially in the manner set forth."

108. For an *Improvement in Machinery for Making Pasteboard;* Orin W. Fiske, Dedham, Massachusetts.

Claim.—"I claim the combination and arrangement of the cylindric paste brushes with three rolls or beams of paper, and compressing and draft rolls, whereby the two cylindric brushes are made to apply at one operation, the paste to the underside of the upper strip of paper, the two sides of the middle strip, and the upper side of the lower strip, all as set forth."

109. For an *Improved Pen and Pencil Case;* Jacob J. Hatcher, Philadelphia, Penna.

Claim.—"I claim, 1st, The permanent attachment of the pencil to the case, operating by the tube sliding over the pencil. Also, the hollow reserve for leads, with the pen holder working over and around the ever point."

110. For an *Improved Iron Picket Fence;* Mathew Walker, Sr., Philadelphia, Penna.

Claim—"I claim the mode of making wrought iron fence, the same consisting in a compound rail composed of two bars of wrought iron corrugated by dies, so that the bars shall embrace the posts or banisters at the proper intervals, and between the same have their inner surfaces in contact, so as to be riveted up close and make a firm and neat fence."

JULY 18.

111. For an *Improved Steam Boiler;* W. E. Bird, Cahawba, Alabama.

Claim.—"I claim the combination of the lower boilers or boiler, and the upper boilers or boiler, with each other and with the furnace, in such a manner that the top of the furnace will be formed of the upper boilers or boiler, and the rear of the furnace be principally formed of the lower boilers or boiler, while the flue space from the said furnace passes between the said upper and lower boilers, and communicates with the flues returning through the lower boiler or boilers, substantially as set forth."

112. For an *Improvement in Cotton Gin Ribs;* Israel F. Brown, Columbus, Georgia.

Claim.—"I claim the employment of a series of cast iron hubs, each having two or more arms cast with them, each of which arms is of proper form to combine with a short rib, and with it form a complete rib, whereby, when the said hubs are secured upon a shaft, arranged in a proper position, their arms may be successively brought into combination with the short ribs, for the purpose of removing the wearing parts, substantially as described."

113. For an *Improvement in Machines for Preparing Flocks for Felting;* Leander W. Boynton, South Coventry, Connecticut.

Claim.—"I am aware that brushes have been used for preparing flock and analogous substances, and that the use of a wire screen is not new; I therefore do not claim either of them, as such; but I claim the combination of a wire screen with a revolving cylindrical brush and one or more stationary brushes, when the screen is placed below the revolving brush, to prevent any of the flock from falling on to the web of wool before it is fully prepared, and also to assist in preparing the flock, when the whole is constructed, substantially as described."

114. For a *Method of Coating Iron with Brass or Copper;* Hugh Burgess, Kentish Town, England; patented in England, February 17, 1853.

Claim.—"The coating of iron sheets, bars, bolts, and other forms of iron with copper or brass, by a combination of processes, as follows: by first cleaning, then coating them over with a solution of cadmium or zinc, drying and dipping them into a bath of

melted copper or brass, and raising them out of the bath into an atmosphere of steam and carbonic acid, flowing in streams or in jets, as described."

115. For an *Improvement in Block Slide Valves for Steam Engines;* Lewis R. Conard, Philadelphia, Pennsylvania.

Claim.—"I claim forming the passages through said valve, so that the oblong steam and exhaust openings shall enter from the upper and lower surfaces, longitudinally to its motion, and leave the opposite surfaces transversely thereto."

116. For an *Improved Method of Making Printing Blocks;* T. Crossley, Boston, Mass.

Claim.—"I do not claim the use of gutta percha as a material for making printing blocks; neither do I claim sawing blocks into prisms, for the purpose of more easily removing those portions of the block not required for the figure; but I do claim the method of making printing blocks, the surface of gutta percha being applied to the surface of the wood, in the manner set forth."

117. For an *Improvement in Bridges;* Samuel Champion and Thomas Champion, Washington, D. C.

Claim.—"We claim, 1st, The combination of tubular braces or struts, made smaller by gradation, or tapering as they extend from the pier or support, with suspension rods also made smaller by gradations, or tapering as they extend from their pier or support. Also, the arrangement described, of the struts, suspension rods, and clamp posts, viz: the oblique struts between the centre post and horizontal strut being placed in lines radiating from a common centre, and the suspension rods being also placed in lines radiating from a common centre, above that from which the struts radiate, in such manner that each suspension rod shall extend from the top of the column or post over the pier or support, to the foot of one of the clamp posts, while each oblique strut shall extend from the foot of the post over the pier, to the head of each clamp post. We also claim the construction of tapering tubular struts of bridges of not less than two concentric sheets, layers, or thicknesses of metal, the sheets of each layer abutting, and those of one layer breaking joints with the next."

118. For an *Improved Mode of Operating Excavating Machines;* Joel A. H. Ellis and Alexander Gordon, Rochester, New York.

Claim.—"We claim, 1st, The placing of the excavating machine within the circuit of an endless chain which passes over a pulley anchored at one point, and over or around a capstan at another point, so that the excavator shall form a part of the endless chain, and be drawn forward or backward, and operated by it. Also, attaching one or both ends of the chain to a drum or shaft connected with the machine, so that the slack of the chain may be taken up on said drum or pulley shaft, to cause the machine to move steadily without sudden strain, or to let out the chain when it becomes necessary to draw it out of its direct line for guiding the machine in any desired direction."

119. For an *Improved Windmill;* Jacob Erdle, West Bloomfield, New York.

Claim.—"I claim the manner or mode of filling the whole wheel with fans or wings, which causes the wheel to be more powerful than it otherwise could be, as it receives the power from the whole current of air that strikes within its circle, and the mode or form of regulating, stopping, and starting the wheel through the centre of the main shaft."

120. For an *Improvement in Tanning;* Roswell Enos, Woodstock, Illinois.

Claim.—"I claim commencing the tanning operation upon the sides, by the use of a salted infusion of sumac, and then completing said tanning operation by the repeated use of the strong oak or hemlock bark liquors."

121. For a *Process for Separating Impalpable Powder for Paints;* Geo. W. Griswold, Carbondale, Pennsylvania.

Claim.—"I claim the process of separating and collecting impalpable from coarser substances, such as ground coal, for the purpose of paint or other mineral substances, by means substantially as described."

122. For an *Improved Mode of Raising Vessels;* Felix Huston, New Orleans, La.

Claim.—"I am fully aware that auxiliary floats to raise vessels have been used, some of which have been so geared as to be rotated for winding up the raising lines or chains; and that levers and weights have been used in connexion with dry docks for raising

vessels in said docks; these I do not claim; but I claim the raising of sunken vessels by means of the careening motion of the side or auxiliary vessels, whether such careening motion is procured by weights run across the decks from side to side of said vessel, or aided by arms projecting beyond said sides."

123. For an *Improvement in Horse Powers;* Wm. R. Palmer, Elizabeth City, N. C.

Claim.—"I claim the combination of the rib or projection upon the arms with the bent pin or iron, or their equivalents, constructed and arranged for the purpose of giving a short bend to the rope or band, and thereby preventing the slipping thereof."

124. For an *Improvement in Machines for Scouring Piece Goods;* J. Augustus Roth and Joseph Lea, Philadelphia, Pennsylvania; patented in England, Feb. 7, 1854.

Claim.—"Our improvement consists in an arrangement of rollers and of revolving dashers, in combination with a vat, whereby several continuous layers of cloth can be simultaneously passed through and acted upon by the water, thus effecting an economy in time and room, and securing a more thorough washing of the material. We claim the combination of the series of distributing rollers and the dasher wheels with the vat."

125. For an *Improvement in Cutting Tobacco;* Ebenezer Murdock, Albany, N. Y.

Claim.—"I claim the process of manufacturing cut tobacco, by mixing with the leaves as stripped of the stems for cutting, the stems previously cut up to a certain degree of fineness, (the object being to facilitate, by the use of said stems, the advantageous cutting of the leaf itself,) the mixed mass then to be cut up together to the requisite fineness, and then the stems to be separated from the cut leaf, which is then ready for use."

126. For *Manufacture of Lampblack;* William G. W. Jaeger, Baltimore, Maryland.

Claim.—"I claim the division of the house lengthwise, with the aperture and the connexion of the two houses by the chambers marked, by which I am enabled to carry the smoke around the whole length of the house, and return it, by means whereof a superior quality and a greater quantity of lampblack is condensed. Also, the use of the two furnaces, in the mode described, by which the manufacture can be carried on uninterruptedly. Also, the waste chimneys that open some distance below the roof, in the manner set forth."

127. For an *Improvement in Hermetical Sealing;* James Spratt, Cincinnati, Ohio.

Claim.—"I do not claim the gasket and screw, nor the wax trough, separately considered; but I claim the screw cap or cover and neck, provided with a gasket of gum elastic (or like substance) at their inner junction, when this is combined with a trough for containing cement around their outer junction, for the hermetical sealing or closing of preserve canisters."

128. For an *Improvement in Steam Gauges;* T. Stubblefield, Columbus, Georgia.

Claim.—"I claim the combination of the hollow cylindrical box, perforated at both ends with a hollow cylinder of india rubber, open at one end and performing the duty of manometer spring, and also separating the perforations in the opposite ends of the box; the several parts being constructed and arranged, and the case connected with the boiler, and the india rubber with the index, as set forth."

129. For an *Improvement in Washing Machines;* H. C. Stevenson, Georgetown, Ky.

Claim.—"I claim the arms and the springs, in combination with the rubber and plate, constructed in the manner described."

130. For an *Improvement in Weavers' Heddles;* Jacob Senneff, Philadelphia, Pa.

Claim.—"I claim forming the eye of the heddle, by casting or otherwise securing around and between the strands or threads composing the same, metallic clasps in lieu of the cumbersome knots heretofore employed, curved on their sides and made concave and smooth on their ends between the strands or threads where they form the ends of the eyes, in the manner set forth."

131. For an *Improvement in Buckles;* Wm. W. Smith, Marshall, Michigan.

Claim.—"I claim the stationary hook or tongue attached to the body of the buckle, as an improvement on the old or loose tongue and buckle, not only in the cheapness of manufacturing them, but in their strength and durability, and the ease with which they are or can be buckled and unbuckled."

132. For an *Improvement in Railroad Car Trucks;* A. Snyder, Hawley, Penna.

Claim.—"I claim making the bearing surfaces of the disks on which the load swivels, and is supported, of an undulating form."

133. For an *Improved Process for Making Steel Direct from the Ore;* Geo. H. Smith, M. D., Rochester, New York.

Claim.—"I claim the process of converting the iron ores, known as the oxides and carbonates, directly into steel, by subjecting the ore in the comminuted state with carbon, and with or without other flux, in a close oven, retort, or other vessel, to a high degree of heat, say about the temperature of what is known as 'white heat,' and then separating the metallic particles from the impurities, and either melting them in crucibles to produce cast steel, or welding and balling them in a reheating furnace, and subjecting the mass to pressure by rolling or hammering to produce spring steel."

134. For an *Improvement in Laying off the Scye in Cutting Garments;* Peter Spilman, Richmond, Va.

Claim.—"I do not claim the laying down of lines on a diagram for determining points of the arm holes of coats, considered irrespective of the precise manner in which these lines are placed, relatively, for I know that diagrams with lines on them, but differing entirely from those which I have invented, have heretofore been made; but I claim the apparatus, consisting of the diagram in the drawings, constructed and operating in the manner described."

135. For an *Improvement in Metallic Fire Places;* John F. Snyder, Culpepper, Va.

Claim.—"I claim forming the screen with narrow metallic strips, having a concave surface, connected by links, making them flexible, and easily coiled into a small space on a cylinder."

136. For a *Machine for Holding Docks of Horses;* Seymour Tomlinson, Pleasant Valley, New York.

Claim.—"I claim the stuffed section or pads, or their equivalents, so constructed as to support the tail of the animal in the required position by its sides, and the hair upon the sides so as to leave the cut, pricked, or scarified portions untouched, thereby permitting them to heal much sooner than if the fixtures which support the tail came in contact with them. Not intending to claim any of the other parts described or represented."

137. For an *Improvement in Winding Rope, Cord, or Yarn;* Philos B. Tyler, Springfield, Massachusetts.

Claim.—"I claim the combination of the friction brake, operated as described, and the sliding belt, or its equivalent. Also, driving the reel by its outer periphery, by the employment of the finger or dog herein described, in combination with the guide, for causing the reel to traverse, the reduction of friction caused by the mode of driving enabling the guide to cause the reel to traverse without too much resistance."

138. For an *Improvement in the Manufacture of Paper from Wood;* Charles Watt, London, and Hugh Burgess, City of London, England; patented in England, August 19, 1853.

Claim.—"We do not confine our claim to the apparatus or utensils, or the manipulations herein named, as they may be varied to suit the circumstances of the case; what we claim is, the pulping and disintegrating of shavings of wood, and other similar vegetable matter, for making paper, by treating them with caustic alkali, chlorine simply, or its compound, with oxygen and alkali, in the order substantially as described."

139. For an *Improvement in Machines for Threading Screws;* George Francis Wilson, Providence, and James Monroe Whitney, North Providence, R. Island; patented in England, April 4th, 1854.

Claim.—"We do not claim the use of a gang or series of cutters, which are allowed to return after each operation, and previous to making a new cut, as this has has been done before; but we do claim arranging the cutters upon the periphery of a disk, or its equivalent, and bring them up to the blanks by a continuous motion, in the manner described. Also, the peculiar manner in which the chasers are made and secured to the cutter head, they being let into grooves or recesses in the head, and having their upper portions hinged to their lower portions, which latter are secured to the head by screws, or otherwise, by which arrangement, while the chasers are held secure from all possibility

of displacement, they may be easily and expeditiously brought up to their work, as required."

140. For *Improved Carriage Springs for Light Vehicles;* Mary Burns, Administratrix of Robert Burns, Jr., deceased, late of the City of New York; patented in England, June 7, 1853.

Claim.—"I claim the combination of india rubber, or other compressible material, with a bar spring having a toggle joint in its centre. Also, the lengthening and shortening of the toggle joint bar between the compressible spring, by means of the screw or nut, by which they are made to sustain their required weight with a proper degree of elasticity, having greater or less stiffness in the spring bracing of the carriage."

141. For an *Improvement in Machines for Pegging Boots and Shoes;* George J. Wardwell, Andover, Maine, Assignor to himself and E. Townsend, Boston, Mass.

Claim.—"I do not claim the combination of a guide point with a set screw to regulate the distance of the pegs from each other; but I claim the combination and arrangement of the guide with the setting point with the handle, the awl or hole punch, the peg driving orifice and mechanism. Also, the combination and arrangement of the spring gauge, lever, or depressor, and the screw, with the handle and peg wood carrier, the object of the same being not only to gauge the space in the peg wood carrier so as to adapt it to peg wood of any desirable width below the maximum that can be used therein, but also to enable a person to move the peg wood downwards, and back of and below the edge of the knife when necessary, so that it may not be moved forwards, under circumstances as before stated. Also, the so combining the spring with the peg wood carrier, peg driver, and gauge lever, that it shall not only serve to support the peg wood, or constitute a bottom to the carrier, but also to force up the peg wood after it has been depressed, either by the peg driver or the gauge lever."

142. For an *Improvement in Machines for Sawing Stone and Marble;* A. H. Tingley, Assignor to himself, E. W., and Hervey F. Tingley, Providence, Rhode Island.

Claim.—"I claim the combination of the two spring pawls, their slotted connecting rod, the movable ratchet, and its tripping pin, with the fixed ratchet of the shaft of the spocket wheel, the whole being operated and made to operate together. Also, the series of hooked pins on the water distributor, in combination with the series of notches applied to the connecting rod for operating the water distributor, the whole being for the purpose of regulating the motion of the water distributor, and of causing that motion to take place over either a portion or the whole entire surface of the stone, as occasion may require."

JULY 25.

143. For an *Improvement in Mail Bag Labels;* Solomon Andrews, Perth Amboy, N. J.

"The nature of my invention consists in the formation of a label, by joining together two pieces of raised metal, or other suitable material, having the superscriptions on the convex sides, and open at both ends so as to admit a strap or chain to pass through it, and capable of being reversed. I disclaim a hinge, or any other adaptation to motion of the two parts of the label upon each other. Also, the stamping of the two sides of the strap, as in ordinary mail bags."

Claim.—"What I claim is, a label formed of two distinct parts, and riveted or firmly secured together, having the superscription on the outside, and open at both ends to admit a chain or strap to pass through it."

144. For an *Improved Device in Machines for Cutting Round Tenons;* Thomas R. Bailey and George Bailey, Lockport, New York.

Claim.—"We claim the arrangement of the tube, exterior to and concentric with the cutting tube, so that the rail may be steadied during the operation of the machine, and the tenon so cut that its axis shall be coincident with the axis of the rail."

145. For an *Improved Method of Securing Helves in Axes, etc.;* Horatio N. Bill and Jeremiah C. Bill, Willimantic, Connecticut.

Claim.—"We claim the peculiar shape of the eye of the axe, in combination with the helve and wedge."

146. For an *Improvement in Nutmeg Graters;* William Bradley, Lynn, Mass.

Claim.—"I claim the combination of the box or holder and its pressure spring with the rasping surface of the grater, when the whole are applied and made to operate together."

147. For an *Improvement in Looms;* Edward W. Brown, Fall River, Mass.

Claim.—"I do not claim the employment of two ratchet wheels upon the same shaft, with teeth in reverse directions, and which are actuated by separate and independent pawls driven by independent machinery; but what I do claim is, the combination of a single pattern chain, and the double acting pawls with the two ratchet wheels upon the cam shaft, for the purpose of driving the latter in either direction, as may be required. 2d, The combination of the ratchet wheels upon the cam shaft, the gearing, and the cam."

148. For an *Improvement in Bottles;* Reinhold Boeklen, Jersey City, New Jersey, and Henry T. Brown, Brooklyn, New York.

Claim.—"I claim constructing the bottle with an oblique cork or stopper passage extending from the mouth downwards through the neck, in such manner that while the lateral pressure on the cork is preserved, the cork passage in no way interferes with or obstructs the straight or direct communication through the mouth and neck of the bottle into the interior thereof."

149. For an *Improvement in Lamp Fastenings;* Lewis B. Carpenter, Buffalo, N. Y.

Claim.—"I claim the combination of the spring with the levers, having the pins or studs which work through the holes into a slot or groove."

150. For an *Improvement in Cotton Gins;* Lewis S. Chichester, Brooklyn, New York.

Claim.—"I claim the mode of operation of the vibrating curved surfaces, for the purpose of forcing seed out of the pods of cotton. Also, in combination, making the said vibrating curved surfaces with recesses to form what is herein termed "the upper griping edges," to act upon the pods near to the seeds towards the end of the operation. And, in combination with the vibrating curved surfaces, the employment of rollers, or their equivalents, acting intermittently."

151. For an *Improvement in Ploughs;* Thomas F. Chapin, Walpole, N. Hampshire.

Claim.—"I claim, 1st, Attaching the beam to the mould board by a pivot, for the purpose of allowing the outer end of said beam to be raised or depressed, as desired, and thereby give the share a greater tendency to enter the earth, and causing the furrows to be of the desired depth. 2d, The means for operating the beam, viz: the box or socket having within it a rack and pinion, the rack being connected to the beam by a rod."

152. For an *Improvement in Bottles;* William Clark, City of New York.

Claim.—"I claim forming bottles with an eye at the top or upper part of the neck, said eye having a passage through it at right angles, or not varying much therefrom, with the opening or passage of the bottle, for the purpose of receiving the cork and preventing the cork from being expelled from the bottle by the force of the gases generated by the fermentation or effervescence of the liquid within it."

153. For an *Improved Arrangement of Spring and Spring Catch for Closing Doors;* John Clark, North Hadley, Mass.

Claim.—"I claim the arrangement of the several parts, (on the casing and on the door,) when the whole is constructed to produce the result, in the manner described."

154. For a *Lubricating Compound;* George A. Colehamer, Reading, Penna.

Claim.—"I claim the combination of 9-16ths of a gallon of raw linseed oil, 7-16ths of a gallon of rosin oil, and 12 pennyweights of gum camphor, for a lubricator."

155. For *Omnibus Step Protector;* Thomas Coles, City of New York.

Claim.—"I claim, 1st, Constructing an appliance or covering for the steps of the omnibus, (made of wood, sheet iron, copper, or other material,) corresponding in width with the door, and the sides falling over the ends of the steps, secured to and moving with the door; and, 2d, Forming metallic triangular plates to be well secured to spring, bar, or otherwise shielding the ends of the hind spring."

156. For an *Improvement in Cultivators;* Charles H. Dana, West Lebanon, N. H.

Claim.—"I claim constructing each of the two outermost teeth with a horizontal

blade, projecting more or less outwardly from its shank, and with an upright portion bent up at the extremity of said outwardly projecting blade, the edge of said upright portion being parallel, or thereabout, with the longitudinal direction of the cultivator, for the purpose of cutting up the weeds close to the rows of corn or other plants, and at the same time drawing the weeds away from the rows, and also serving to guide the attendant in directing the cultivator so as not to injure the plants by too near an approach to them."

157. For an *Improvement in Striking part of Steeple Clocks;* G. Deuble, Canton, O.

Claim.—"I claim attaching to the beam or lever, which is operated by a pin on the wheel, and is provided with a detent for arresting the fly, the knee or its equivalent, to act in conjunction with the pins in the count wheel, as an inclined plane to raise the lever, till its detents take effect, and to escape from the pins when the lever is still further raised by the pin on the wheel."

158. For an *Improvement in Finishing Dies in Machinery for making Rings from Sheet Metal;* Charles W. Dickinson, Newark, N. J.

Claim.—"I claim forming the lower finishing die in two parts, of which the part (s′) is capable of being raised to effect the finished ring or link."

159. For an *Improved Arrangement for Lathe Chuck;* L. A. Cole, Salem, Ohio.

Claim.—"I claim the manner of combining and arranging the scroll screw, holding jaws, screw or mandrel, cutter, adjustable nut, gauge plate, sliding catches, and notched and grooved barrel, or their equivalents, for the purpose of constituting a machine which is capable of boring the hub entirely through in a true and perfect manner, and also of being adjusted and set so as to cut a shoulder of the required depth, and to enter the proper distance, and then of being adjusted as the operation is proceeded with, so as to square up the shoulder in a perfect manner."

160. For an *Improved Mode of Driving and Straining Saws;* James Fishwick and John Fishwick, Lexington, Kentucky.

Claim.—"We claim driving and straining the saw by two steam cylinders and pistons of unequal size, the larger being of sufficient size to drive the saw during its downward or cutting movement, and only receiving steam during such movement, and the smaller, which always contains steam, being of sufficient size to keep the saw strained while cutting, and to raise it and the larger piston."

161. For an *Improvement in Reading Tables;* Chas. Folsom, Cambridge, Mass.

Claim.—"I claim a combination of the tables with the levers."

162. For a *Mowing Machine;* Alanson Gale, Poughkeepsie, New York.

Claim.—"I claim the wheel, when so constructed and combined with the frame of a mowing machine as to support the cutter bar clear of the ground when pushed back, and lower it to its place when drawn forward."

163. For *Improved Machinery for Crushing and Pulverizing Ores, &c.;* Samuel Gardiner, Jr., City of New York.

Claim.—"I claim the employment of one or more stampers, having such a jumping motion as to leave them for some time in contact with the quartz or ore after every descent, and such a rotary motion that while they remain in contact with it between one descent and their next ascent, their rotary action will be sufficient to pulverize to a proper degree, that which was prepared by the breaking or crushing action of their descent."

164. For an *Improvement in Vehicles;* Abram J. Gibson, Clinton, Massachusetts.

Claim.—"I claim giving to the forward axle a bent form, in combination with arch springs, connected and bearing from axle to axle."

165. For an *Improvement in Butter Workers;* Ezekiel Gore, Bennington, Vt.

Claim.—"I claim a machine provided with an endless revolving sack, and having its parts arranged and operating for working, cleansing, and seasoning butter."

166. For an *Improvement in Grates;* Geo. W. Griswold, Carbondale, Pa.

Claim.—"I claim the hinging of the shakers in front of the grate, so as to give the ends thereof next the back the greatest extent of motion, and this in combination with the stops, which prevent the shakers from rising above the bottom of the grate."

167. For an *Improved Mill Stone Dress;* Edmund P. Gaines, Melrose, Texas.

Claim.—"I claim the manner of laying off the dress of mill stones with four curved master furrows, (by which I gain a draft equal to one-fourth the circumference,) in connexion with secondary furrows laid according to the directions given, for the purpose of more effectually grinding grain, increasing the quantity ground with a given power, producing a better yield of superfine flour, and avoiding both the choking and undue heating of the stones."

168. For an *Improved Water Wheel;* Benajah T. Hall, Seneca Falls, New York.

Claim.—"I claim the combination of the beveled or inclined curb with the central discharge water wheel; and, also, the eccentric discharging orifice, or its equivalent."

169. For an *Improvement in Bank Locks;* Augustus C. Harig and David C. Stoy, Louisville, Kentucky.

Claim.—"We claim the self-adjusting guard, arranged and operating the "usher," c, in such a manner that the introduction of powder or picking instruments into the lock through the key hole, is effectually prevented. Also, the arrangement and combination of the cam, which operates the belt, the dog, and the eccentric notch in the "usher," c, in such a manner that while the key, or any instrument substituted therefor, may be operating upon the tumblers, the said cam shall be intercepted by the dog, so that it cannot be brought into contact with the bolt, till said key or instrument shall have moved the tumblers as far as it is capable, for the purpose of preventing the act of "feeling" the positions of the tumblers, while the key or substituted instrument may be moving them."

170. For an *Improvement in Windows;* Mark A. Heath, Providence, Rhode Island.

Claim.—"I claim inserting in either side of the sash, a flexible expanding strip, formed in lengths, jointed or otherwise pliantly secured together, so that the sash is made to slide smoothly in the frame, the several lengths of the strip expanding and contracting to accommodate themselves to inequalities in the grooves in which they slide, for the purpose of forming a close joint between the sash and the frame."

171. For an *Improvement in Shirt Collars;* Walter Hunt, City of New York.

Claim.—"I do not claim making collars of paper; neither do I claim the peculiar fabric which I make use of; nor the enamelling and polishing such fabric; nor do I claim making paper or cloth water proof by means of varnish; but what I do claim is, the above described shirt collar, made of the fabric set forth, and polished and varnished in the manner and for the purpose specified."

172. For an *Improved Steam Boiler;* H. Jackson, of the Township of Elizabeth, Ohio.

Claim.—"I claim ,1st, The arrangement of the vertical water tubes and spiral flues in relation to the furnace, as described. 2d, The arrangement of the vertical water tubes surrounded by the non-conducting material, and the upper and lower horizontal tubes, in connexion with the heating surfaces, for the purpose of returning the water from the upper to the lower tube."

173. For an *Improved Device for Securing Ends of Wires in Fence Posts;* Wm. G. Lavers, City of New York.

Claim.—"I claim the method of securing the horizontal wires to the posts by having slots made in the posts, in pairs, and the ends of the wires passed through the lower slots of the several pairs, and bent in the form of hooks, the lower ends of the hooks passing through the lower slots of the several pairs, and placed either obliquely or vertically."

174. For an *Improvement in Cultivators;* Griffith Lichtenthaler, Limestoneville, Pa.

Claim.—"I claim the method of attaching the shares to the beams, viz: having metal strips, perforated with holes, secured to the undersides of the beams, and sockets formed of two lips made at the upper ends of the shares, and perforated with holes, in which holes, and in the holes in the plate, wooden pins are passed, securing the shares to the beams."

175. For an *Improvement in Eyelet Machines;* Hymen L. Lipman, Philadelphia, Pa.

Claim.—"I claim the so forming of the die and counter die, or follower and anvil block, of an eyelet machine, by concave grooves, channels, or their equivalents, as that the eyelets may be raised or clinched on both sides by a single operation, and without turning them over."

176. For an *Improved Coupling for Carriages;* Norman B. Livingston, Portland, Ind.

Claim.—"I claim coupling the front axle to the reach, and also the whiffle-trees of a wagon or carriage to the tongue, by means of the circular collar or eye-piece and grooved sectional circle plate."

177. For an *Improvement in Ditching Ploughs;* John Lyon, Harrisburgh, Iowa.

Claim.—"I claim the arrangement of the several parts, for the purpose of constituting a machine which is capable of cutting any depth of furrow, and of taking up the loose dirt or soil out of said furrow or ditch, as fast as it is formed, and convey and discharge it at right angles to the furrow or ditch, in a continuous stream, for the purpose of forming roads and foundations for fences, and for other purposes."

178. For an *Improved Mode of Securing Staples to Walls;* Jordon L. Mott, Mott Haven, New York.

Claim.—"I claim forming the anchor of a block cast on to the shank of a wrought iron staple or eye, and provided with a thin wing having flanches or ribs all cast and forming one substance with the block, whereby the cast iron part shall hold the shank firmly, and at the same time become an integral part of the mason work, and be firmly held therein by the superincumbent weight."

179. For a *Portable Soda Water Fountain;* James R. Nichols, Haverhill, Mass.

Claim.—"I claim, 1st, The peculiar arrangement of reservoir, generator, and purifier, compactly combined, as described. 2d, The arrangement for gradually throwing down the powdered chalk or soda, from the superior cylinder, and for closing up the same by drawing up the rod connected with the thumb screw."

180. For a *Mode of Stopping Mineral Water Bottles;* A. Quantin, Philadelphia, Pa.

Claim.—"I claim the compound stopper composed of the metallic core, the cork zone, and the india rubber spring."

181. For an *Improvement in Stove Regulators;* Washburn Race, Assignor to Horace C. Silsby and Washburn Race, Seneca Falls, New York.

Claim.—"I claim adjusting the stove regulator by attaching the nut and screw used for that purpose, at the top end of the same, and at the top of the stove."

182. For an *Improvement in Butter Workers;* Elihu Ring, Macklenburgh, N. Y.

Claim.—"I claim arranging the block to traverse, in combination with the spring, or its equivalent, to force it forward in the operation of working butter."

183. For an *Improvement in Platform Scales;* Elnathan Sampson, Windsor, Vt.

Claim.—"I claim the combination of the short longitudinally vibrating levers with the laterally vibrating longitudinal lever, by which I am enabled to construct scales of the largest size without using trussed levers. Also, the combination of the platform with the beam actuating double lever, or its equivalent, through the medium of the longitudinally vibrating levers and the laterally vibrating lever. Also, inserting a double concave intermediate block within the opening of each stirrup, between the sharp edge of the cross of the stirrup and the edge of the lever pivot, at right angles therewith, for the purpose of enabling the platform to swing freely in a lateral and longitudinal direction, without injury to said sharp bearing edges."

184. For an *Improvement in Sheet Metal Candlesticks;* J. W. Smith, Poultney, Vt.

Claim.—"I claim forming the base of a sheet metal candlestick of two sheets of different metals, which are of such proportions, respectively, that the upper is too thin to support the candlestick by itself, and has the requisite stiffness and strength imparted to its central portion, by fitting and firmly uniting thereto the under sheet."

185. For an *Improvement in Corn Cob Cutter;* Isaac Straub, Cincinnati, Ohio.

Claim.—"I claim the combination of a rotating burr provided with a blade or cutting edge on top, and with a toothed or roughened surface on its perimeter, and a stationary shell, also provided with a cutting edge, operating together sheer fashion, for slicing off and reducing ears of corn, preparatory to their undergoing a farther reducing or grinding operation."

186. For an *Improved Ditching Spade;* David Stouder, New Burlington, Indiana.

Claim.—"I claim the combination of the obtuse angled bottom cutter with the side cutters sloping upwards, the light steel ribs, the foot treads on the single or divided handle, and the claw hook for deep trenching."

187. For an *Improvement in Horse Shoes;* Wm. H. Towers, Philadelphia, Penna.

Claim.—"I claim the combination of the steel or other elastic springs having corks formed on their flexible ends, and capable of being removed and attached with facility and despatch, with the main body of the shoe."

188. For an *Improved Arrangement of Indicating Tubes for Ascertaining Draft of, and for Trimming Vessels;* John E. Vansant, Louisville, Kentucky.

Claim.—"I claim the arrangement of tubes and indicators, in the bow, stern, and quarters or wings, of light draft vessels, for the purpose of keeping her trimmed by indicating the true draft of water throughout her length and breadth, and preventing the hogging or straining of the hull."

189. For an *Improvement in Paddle Wheels;* Abraham Van Antwerp, Albany, N. Y.

Claim.—"I claim the construction and use, upon steamboat paddle wheels, of disconnected floats of a cima-recta and cima-reversa form, as shown, the same being placed upon arms set obliquely upon the shaft, and being so formed and placed that the end of the float enters and leaves the water on a line parallel with the direction of the vessel, whereby the beating down of the water by the float when entering, and the raising up of water when leaving, as in the ordinary transverse paddle, is prevented."

190. For an *Improvement in Seed Planters;* Charles A. Wakefield, Plainfield, Mass.

Claim.—"I claim so arranging and operating the plunger, in connexion with the receiving tube or chamber, and its delivery slide, or the equivalent thereof, that the plunger ejecting the corn deposited in the receiving chamber, is made to imbed the corn, from the surface of the earth to its required depth, obliquely into the ground, while the receiving tube or chamber, resting by a front stop plate on or above the ground, is made to open and close clear of all surrounding dirt, and the sides of the said chamber made to act as scrapers above the recesses to clear the plunger of adhering soil, and cover the seed therewith, throughout the entire withdrawal of the plunger, whereby the receiving tube or chamber is prevented clogging with dirt at its opening sides, the width of the opening made in the earth for the reception of the seed is diminished, and the corn covered with more certainty. Also, the method of operating the planter by the hand, at the side, in such a manner that the same force or pressure applied to working the plunger up and down, gives to the planter, automatically as it were, one and the same obliquity of stroke, in a backwardly direction downwards, or in a forwardly direction upwards, throughout its several operations, both on entering and leaving the ground, by means of the obliquely set handle on the rear side of the plunger, or other equivalent arrangement of the handle, producing the same action, and whereby the planter may be used with greater facility and expedition, and the recess formed for the planting of the corn be made with certainty of the necessary obliquity, without involving any delay in adjusting the direction or movement of the plunger to insure the earth, on the overhanging side of the said recess, falling in to cover the corn."

191. For an *Improvement in Polishing Wheels;* Benj. Webb, Unadilla Forks, N. Y.

Claim.—"I claim the forming of an elastic polishing wheel for polishing and grinding by the use of a series of springs placed under sections of the surface, moving vertically from the centre, and independent of each other."

192. For an *Improved Mode of Fitting Heads in Boxes;* C. Williams, Fallsburgh, Va.

Claim.—"I claim the angular form of three pieces of heading, which allows these being put in securely and often removed, without drawing a nail or moving a hoop."

193. For an *Improvement in Portable Bedsteads;* S. Willard, Cincinnati, Ohio.

Claim.—"I claim a bedstead, constructed of sheet metal side and end pieces, which are bent at their ends so as to form sockets for the reception of the sustaining and uniting posts, and provided with inward flanches at their lower edges for the reception of the hinged bottom plate, which serves at the same time to support the bed, and to keep the bedstead firm and in proper shape."

194. For an *Improvement in Apparatus for Cooking and Warming;* Daniel Willis, City of New York.

Claim.—"I claim the arrangement, construction, and united operation of the several devices forming the cooking and warming apparatus herein shown."

195. For an *Improvement in Hedge Trimmer;* Leonard Woods, Quincy, Illinois.

Claim.—"I claim, 1st, The arrangement of the cutters affixed on the face of a wheel on an inclined shaft, revolving so as to cut upwards as the carriage is advanced parallel to the sides of the hedge. 2d, The gauge, in combination with the horizontally revolving knives, both being adjustable to the required height for topping the hedge. 3d, Lifting the lower branches of the hedge to bring them within the range of action of the revolving cutters, by means of the bent bar, or its equivalent, thereby obviating the necessity of having the cutter wheel of large diameter, and allowing the cutters to be carried so high as to be free from all danger of striking the ground."

196. For an *Improvement in Cider Mills;* Daniel Ziegler, Lewistown, Penna.

Claim.—"I claim the arrangement of the spur teeth on the rollers in rows round the periphery of regular sizes in each row, but the teeth in the one row being larger than the teeth in the adjoining row, and the smaller teeth of the lower roller being arranged opposite the larger teeth of the upper rollers, and all three rollers running at different velocities."

197. For an *Improvement in Thimbles for Stove Pipes;* Daniel Wilson Assignor to Wm. F. Pratt, G. W. Bosworth, and H. M. Bird, Milford, New Hampshire.

Claim.—"I claim the combination of the rings, the thimble, the sliding plates, and the cover, with the ventilators."

198. For an *Improved Mortising Machine;* Birdsill Holly, Assignor to Silsby, Race & Holly, Seneca Falls, New York.

Claim.—"I claim the mode of working the chisel, consisting of the re-entering belt, or its equivalent, in combination with the spring and hand or foot straps, and in combination therewith, I claim the tongue strap, with its spring, for the purpose of keeping the belt loose upon the driving shaft. Also, the mode of reversing the chisel, or of keeping it in and out of gear, consisting in the combination of the hinged bar, the spring, the notched ring, the treadle, or its equivalent, and the rod connected with the gear wheel on the pulley frame."

199. For an *Improved Arrangement of Means for Working and Stopping Chain Cables;* T. Brown, London, England; patented in England, April 20, 1847.

Claim.—"I claim the arrangement of the capstan, the removable rollers, and the sockets for said rollers, in such a manner and having such relations to the hawse holes, chain locker deck pipes, and under-lifting stoppers, that a chain cable can be continuously hove in by means of said capstan and rollers, or be directly run out of the lockers, without any previous overhauling. Also, the arrangement of the under-lifting bow stoppers and after stoppers, by which more cable can be gradually and controllably given to a vessel, whilst riding heavily at anchor."

ADDITIONAL IMPROVEMENT.

1. For *Improvements in Looms for Weaving Figured Fabrics;* Saml. Eccles and Jas. Eccles, Philadelphia, Pennsylvania; dated July 18, 1854; original patent dated August 3, 1852.

Claim.—"We intend to apply the stop motion herein described, to looms having other kinds of shuttle box motions attached, and shall vary the form of the parts to suit the necessities of the various cases. We claim the mechanism which connects and disconnects the shuttle box motion to and from the cam shaft, that is, the bell crank lever, when kept in connexion with the grooved hoop or collar, by a spring, or its equivalent, in combination with the lever and its connecting rod, or any mechanical equivalent therefor, when the said lever is operated upon by a filling thread stop motion, when the filling thread breaks or becomes expended. Also, the pattern chain composed of lags, having projections or segment flanches on the top, and blank lags having no projections

on the top, for the purpose of operating rise and fall shuttle boxes therewith in power-looms for weaving figured fabrics."

RE-ISSUES FOR JULY, 1854.

1. For an *Improvement in Machines for Pegging Boots and Shoes;* J. J. Greenough, City of New York; patent dated Jan. 17, 1854; re-issue dated July 4, 1854.

Claim.—"I claim the cutting of the peg from the peg blank, by a lateral motion of the cutter against the side of the blank, the cutter assisting to hold the blank in position while it is driven. Also, the combination of parts composing the "universal movement carriage," consisting of a disk supported upon the arm of a horizontal lever, so that it can be raised or lowered, surmounted by the device for holding the work, having a free motion in all directions. Also, the centre guide for directing the movement of the shoe or other article in the course indicated by the pattern of the sole, for the purpose of keeping the line of the pattern incident with that of the awl and peg driver. Also, so constructing, arranging, and operating the shoe carriage that each point of the sole which is to receive a peg shall be brought successively to the same point under the stationary pegging standard, so that the pegging shall be effected without interruption entirely around the shoe or other article. Also, in combination with the movable carriage, the stationary pegging standard made adjustable, or the equivalent of that adjustment, so that the pegs can be driven at any distance from the edge of the sole or centre of motion of the carriage holding the material to be pegged, so that a new pattern will not be required to drive a second row of pegs within the first row. Also, driving the pegs by a tool having a positive motion in both directions."

2. For an *Improvement in Gun Locks;* James Hultz, Berlin Township, Ohio; patent dated May 16, 1854; re-issue dated July 4, 1854.

Claim.—"I claim giving such a shape to the tumbler, or to the sear, or their equivalents, that the sear will not catch and safely hold back the cock in a cocked position, except when it is acted upon by a perfectly rigid force. And, in connexion with the said peculiar arrangement of the tumbler and the sear, I also claim the combination of the jointed levers with the sear, in such a manner that said levers will rigidly act upon the sear, and cause it to safely hold the cock when it is thrown into a cocked position. Also, the set screw, arranged in such a manner in relation to the jointed levers, the sear, and the tumbler, that its adjustment to a greater or less extent will render it necessary to exert a greater or less degree of power upon the trigger to detach the sear from its hold upon the tumbler, when the cock is in a cocked position."

3. For an *Improved Journal Box for Saw Mill Carriages;* Charles Fox, Chicago, Ill.; patent dated May 9, 1854; re-issue dated July 18, 1854.

Claim.—"I claim the combination of the notched plate, pawl, rack, pinion, lever, and sectional pawl, arranged as set forth. Also, the construction of the boxes with the opposite inclined inner faces, for giving the requisite set-off to the carriage when gigging back, and again setting up when moving forward for the cut."

4. For an *Improvement in Seed Planters;* Charles Randall, Palmyra, Georgia; patent dated November 2, 1852; re-issue dated July 25, 1854.

Claim.—"I claim the revolving cylindrical hopper, composed of two hollow buckets or disks, arranged a suitable distance apart, to form a central discharge passage in a horizontal revolving shaft, for the purpose of holding and agitating the seed and discharging it in the centre of the furrow in a straight line."

DESIGNS FOR JULY, 1854.

1. For a *Tea or Coffee Pot;* William Hattersley and Charles Dickinson, Newark, N. J.; dated July 4, 1854.

Claim.—"The design of the ornamental work."

2. For *Cooking Stove;* John C. Smith, Assignor to C. W. Warnick and F. Liebrandt, Philadelphia, Pennsylvania; dated July 11, 1854.

Claim.—"The several ornaments in bas-relief and mouldings, forming the design of stove 'Great Republic.'"

3. For a *Radiator Stove;* S. H. Sailor and John C. Smith, Assignors to C. W. Warnick and F. Liebrandt, Philadelphia, Pennsylvania; dated July 11, 1854.

Claim.—"The ornaments in bas-relief on the body, foot, and urn, of the stove 'Lady Washington Radiator.'"

4. For a *Cooking Stove;* Harrison Eaton, Assignor to James Hartshorne and Winslow Ames, Nashua, New Hampshire; dated July 11, 1854.

Claim.—"The ornamental design for the side plate and its feet, and that of each door."

5. For *Well Curbs;* William Douglass and Benjamin Douglass, Middletown, Conn.; dated July 11, 1854.

Claim.—"The design displayed by a combination of the form and ornaments."

AUGUST 1.

1. For an *Improvement in Machinery for Making Matches;* Elkan Adler, City of N. Y.

Claim.—"I claim the perforated dipping board, moved and combined with the sliding frame. The combination of the springs, levers, shafts, pawls, rods, and button. The knives, in combination with the connecting piece, crank and lever. The grooved rollers, in combination with drum, grooved tables, and knives. And, the combination of the driving wheel, roller wheels, intermediate wheel and drum wheel, as set forth."

2. For a *Lubricating Material;* Wm. Little, of the Strand, County of Middlesex, England; patented in England, July 14, 1853.

Claim.—"I claim the combination of the "coal oil," or heavier oily product resulting from the second distillation of bituminous coal, (or a matter that will so produce a like oil,) with a saponified vegetable, animal, or fish oil or fat, and whether the coal oil be combined with the vegetable, animal, or fish oil or fat, after or during the saponifying process of the said composition, being intended as a lubricator for machinery."

3. For *Improved Bits for Carving Machines;* Charles F. Bauersfield, Cincinnati, O.

Claim.—"I claim the formation of an excavating bit, having its longitudinal contour corresponding to the designed vertical section of the relievo, and grooved along its sides and across its lower end or face, at or near the plane of its axis."

4. For an *Improvement in Brick Presses;* Collins B. Baker, Troy, N. York.

Claim.—"I do not claim constructing a sector shaped follower with a rectilinear nor a single curved concave pressing surface; but what I do claim is, constructing it with a pressing surface of two circular or curved concaves, which are proportioned to the increase of the distance from the centre of motion of the quadrant."

5. For an *Improvement in Steam Boiler Tubes;* R. C. Bristol, China, Michigan.

Claim.—"I claim the cutting, impressing, or otherwise increasing one of the surfaces of tubes or sheets of metal, which said surface is to form the radiating side of boilers, flues, or vessels, for the purpose of imparting heat to any liquid, vapor, gas, or to atmospheric air, when said cutting or impressing is of such a character as to admit of being made after the plates are bent up into form."

6. For an *Improvement in Stone Saws;* George W. Cherry, City of New York.

Claim.—"I claim, 1st, Constructing saws or blades for sawing or cutting stone, with inclined side grooves extending entirely across the body of the saw or blade. 2d, The use of fine grooves, depressions, or holes, made in the saws or blades between the sand passages. 3d, Constructing saws or blades alternately of hard and soft metal in the direction of their length."

7. For an *Improvement in Drying Thick Paper;* Ephraim and John R. Cushman, Amherst, Massachusetts.

Claim.—"We claim our process of drying thick paper, and at the same time preventing it from warping out of shape, to wit: by placing the sheets, in a pulpy state, upon heated tables or platforms, and allowing them to remain until they harden to such a degree as to begin to warp out of shape, and then causing open or lattice weights to be let down upon them, which rest upon their edges or points at different parts of the sheets, and preserve them in flat positions until entirely dry."

8. For an *Improvement in Door Locks;* William Cayce, Franklin, Tennessee.

Claim.—"I claim the arrangement of the levers and pawls with the bolt, the levers being guarded by the tubular key hole projecting inwards over them, and the pawls protected by the broad bolt beneath them."

9. For an *Improved Machine for Uniting Plates of Metal of Unequal Thickness;* J. Carhart, City of New York.

Claim.—"I claim, 1st, Making the punch and die of such relative sizes that the punch shall be incapable of entering the die at all, or of entering it with the same degree of freedom as would be necessary in an ordinary punching operation. 2d, Making the punch holder with a concave recess in its face, or otherwise furnishing the back of the punch with a shouldered face, which shall bear upon the face of the piece of metal which is entered by the punch, only in a ring at a distance from the punch. 3d, The employment of an upset plate, placed, after the punching operation, between the die and that portion of one plate or piece of metal which is protruded through the other, so that by repeating the movement of the punch, the said protruding portion may be upset or riveted. This I claim, irrespective of any mechanism that may be employed to carry the upset plate to and from the die."

10. For an *Improvement in Hot Air Furnaces;* John Carton and Joseph Briggs, Utica, New York.

Claim.—"We claim the inverted cone or deflector, when placed at the top of the chamber of hot air furnaces, constructed in the manner set forth."

11. For an *Improvement in Magneto-Electric Machines;* Ari Davis, City of N. York.

Claim.—"I claim the insulation of the journal of the shaft, in combination with the single conducting spring in magneto-electric machines."

12. For *Improvements in Drafting and Modeling Vessels;* Henry C. Deputy, Michigan City, Indiana.

Claim.—"I claim the application of diagonals to drafting and modelling all kinds of vessels propelled by sails, steam, or otherwise. Also, the principle by which the exact concavity of concave water lines is determined, viz: by transferring the intersections of the water lines (in the body plan) with each frame to a half breadth plan."

13. For *Improved Machine for Sawing Fire Wood;* John J. Efferenn, Springfield, Ill.

Claim.—"I claim the combination of a saw and saw horse with fly wheels, as described, through the agency of a lever, arm, and crank."

14. For an *Improvement in Machines for Moulding Crackers;* Phineas Emmons, City of New York.

Claim.—"I claim the use of the roller, made with cutters in its channel, in combination with the feed rollers, for forming and cutting dough into suitable shapes for making crackers. I also claim as new, for rolling dough into ball, the conical or nearly disk form of the wheels, whereby they are made, by their oblique position on their axes, to combine a twisting and rolling motion, the rolling motion only having been heretofore employed in cylindrical grooved rollers."

15. For an *Improvement in Revolving Breech Fire Arms;* Josiah Ells, Pittsburgh, Pa.

Claim.—"I claim, 1st, The use of a stud in the trigger, vibrating laterally, in combination with a level edged hammer, with a notch at its toe, by means of which, by simply pulling the trigger, the hammer is raised, and may be either allowed to stand at full cock, or fired at pleasure, while the trigger, after firing, will regain its position for repeated action. 2d, The use of a double spring, or spring and lever, for the purpose set forth. 3d, The mode of locking the rotating breech at the moment of firing, by means of the locking bolt, in combination with the cam shoulder on the trigger, and the hexagonal neck of the rotating breech, which nevertheless permit the breech to be fully rotated, by hand or otherwise, when the trigger is not drawn back."

16. For an *Improvement in Compasses and Callipers;* John E. Earle, Leicester, Mass.

Claim.—"I claim the combination of the hinged arms, screw rod and nut, with the hinged legs of compasses or dividers and callipers, for the purpose of moving or holding said legs in both directions, any where within the line of their sweep."

17. For an *Improved Pen;* W. R. Glover, Glasgow, Kentucky.

Claim—"I claim attaching lips to the pen, for the purpose of preventing the ink from ascending in the pen, and coming in contact with the fingers."

18. For an *Improvement in Brick Presses;* Isaac Gregg, Pittsburgh, Penna.

Claim.—"I claim giving a quivering or shaking motion to the combined brick discharger and mould duster, by means of the elastic pin which projects therefrom, acting upon the serrated edge, or by any other equivalent means, for the purpose set forth. Also, the cutters or pulverizers, when arranged and operating in combination with the pressure roller, for the purpose of breaking up and pulverizing the hard crusts of clay produced by said roller, and for properly working and supplying clay to the moulds."

19. For an *Improvement in Lathing Buildings;* B. F. Gold, New Haven, Conn.

Claim.—"I claim, 1st, The mode of making spaces between lath by turning spacing pins which are attached to slides, the mode of turning being by arms. 2d, Stationary spacing pins to make equal spaces between breaks of lath, and as a permanent footing against which lath are spread to touch the gauges. The spacing pins are on the rear of the frame. 3d, The gauges which are placed in front of any required number of lath, and are requisite to control the width of breaks, the spaces between lath, and to keep them level."

20. For an *Improvement in Mode of Attaching Thills and Poles to Vehicles;* Abram J. Gibson, Clinton, Massachusetts.

Claim.—"I claim the manner of attaching thills or poles to vehicles, by means of a steel spring, or its equivalent."

21. For an *Improved Mode of Attaching Whiffle-trees to Vehicles;* Abram J. Gibson, Clinton, Massachusetts.

Claim.—"I claim the manner of attaching the whiffle-tree to vehicles, by means of a steel spring, in the manner as set forth."

22. For an *Improvement in Wash Boards;* Joseph Hyde, City of New York.

Claim.—"I claim, 1st, The employment of the elastic or semi-elastic 'knuckles,' each distinct, but the whole forming a compact series over the whole rubbing surface of a wash board, of any usual or convenient form. 2d, I claim, in combination therewith, the rubber connected to it, so as to reverse to either side of the 'board,' and 'swiveling,' if desired, in its own immediate bearings."

23. For an *Improvement in Shot Pouches;* John M. Hathaway, City of New York.

Claim.—"I claim the devices for securing the top or chargers to the pouch, viz: the lugs, slots, and thumb catch, operating as set forth. Also, the method of gauging the charges by means of the inner and outer tubes or barrels, moving one within the other, and the slides working therein, and adjustable by means of the hollow thumb lever rod and nut."

24. For an *Improvement in Railroad Car Couplings;* D. A. Hopkins, Elmira, N. Y.

Claim.—"I claim having the draw head formed with a wide or flaring mouth and narrow neck, and using, in connexion therewith, a block, the front surface of which is of circular concave form, with recesses across it, whereby the links may be held in a horizontal or in inclined positions."

25. For *Improvements in Submerged Paddle Wheels;* W. F. Ketchum, Buffalo, N. Y.

Claim.—"I claim the arrangement of the centrifugal wheel relatively to the charge and discharge openings of the casing and the division of the interior of the said casing by the partitions, and so as to form the openings, so that the wheel shall take in water at its centre, and discharge it out of said openings on each or both sides of the stern post."

26. For an *Improved Mortising Machine;* William Henry Morrison and M. W. E. Doran, Indianapolis, Indiana.

Claim.—"We claim the combination of the alternately rising and falling chisels with the auger, so that both are in operation at the same time, as set forth, or by any known equivalent mechanical means; also, the combination of a number of such sets of chisels and augers, as described, for cutting mortises of greater or less length, as may be desired."

27. For an *Improvement in Houses for Switch Tenders;* Willis Mansfield, New Haven, Connecticut.

Claim.—"I claim the connexion between the switch house door, or its equivalent, and the switch or the actuating mechanism thereof, when said mechanism is arranged in the manner described."

28. For *Improvements in Stone and Marble Saws;* William Watson, City of N. Y.

Claim.—"I claim making saw plates for cutting stone, with channels at the sides, substantially for the supply of sand to the lower edge. Also, the excavations or notches on the lower edge, to contain and permit the sand more effectually to get under the edge of the saw plate."

29. For *Improvements in Feed Water Apparatus to Steam Boilers;* Benjamin F. Bee, Harwich, Massachusetts.

Claim.—"I do not claim, of themselves, in the boiler feeders, a water chest and slide valve, operating in connexion with a water supply vessel, and arranged so as to be self-regulating in keeping up a proper level of water in the boiler; nor yet do I claim causing the steam from the boiler to act, by pipes conveying it thereto, upon the surface of the water in the supply vessel to facilitate the discharge of water therefrom to the boiler. But I do claim the arrangement of the double slide valve water chest, and steam and water passages, with the water supply vessel, when the said supply vessel is made a compressed air receptacle by the immersion of the supply pipe below the top surface of the water therein, or the compression of the air in the supply vessel being otherwise equivalently produced, and so that a strong atmospheric pressure is brought to bear upon the surface of the water, to serve, conjointly with the steam passing from the water chest through pipe into the compressed air receptacle, to establish that necessary equilibrium of pressure above and below the water in the supply vessel, to produce a flow, and whereby the effect, by condensation or cooling of the steam entering the supply vessel, is neutralized, and a more immediate and certain discharge of water into the chest insured. And I further claim the method of varying the height at which the water will be sustained, by raising and lowering the chest and its attachments."

30. For *Improvements in Machines for Sticking Card Teeth;* G. W. Coats and J. Russell, Springfield, Massachusetts.

Claim.—"We claim the mode of imparting the intermittent motion to the main carriage for spacing the teeth, and reversing the same by means of the screw leader attached to the main carriage, and passing through a nut mounted in suitable boxes and rotated by cog gearing, when this is combined with a clutch operated by a cam, to clutch and unclutch the wheel, which receives motion from the wheel or wheels on the main shaft, and imparts the required and measured intermittent motion to the nut. Also, in combination with the mode described, of imparting the spacing motion to the main carriage, the employment of the cams on the main carriage, which, at the end of each transverse motion, act on a lever connected and combined with and operating the clutch to clutch and unclutch the wheel which receives motion from the main shaft, to operate the shifting wheel which operates the double clutch on the main shaft. Also, in combination with the mode described, of operating the main carriage, the mode of operating the second carriage which holds the sheet of leather to determine the space between the rows of teeth, by means of the shifting cam called the twill cam, and the shifting sector cog wheel, which in turn imparts motion by the cog wheels and shaft to the cog wheel through which passes the feathered shaft mounted on the main carriage, and which in turn imparts the required motion to the drums for lifting the second carriage at the end of each complete motion of the main carriage; and, in combination with this, we also claim making the nut on the screw leader in two parts, divided by a plane at right angles to the axis, when the two parts are attached together so that they can be turned on each other, substantially as described, so that the threads can be set to any wear of the threads, and thus avoid end play, as described. We also claim making the arbors of the two rollers with cylindrical bosses to determine their distance apart, in combination with the mode of mounting them between boxes and without interposed boxes, the said arbors being prevented from having end play by means of V shaped or curved fillets on the arbors, fitted to corresponding cavities in the boxes. We also claim mounting the bending fingers in the sliding top plate, independent of and below the slide or carrier of the former, around which the teeth are bent, the said carriage being provided with an inclined plane or cam, acted upon by a like inclined plane or cam on the top plate of

the fingers, so that as the fingers are drawn back, the former shall be lifted up preparatory to its back motion."

31. For an *Improvement in Mechanism for Measuring Cloth on Looms;* Halvor Halvorson, Assignor to H. Halvorson and Horace Barnes, Boston, Massachusetts.

Claim.—"I claim the combination of the following mechanical elements, or their equivalents, when operated by a stud from the lay, and by means of the cloth, as specified, the said combination being as follows: 1st, The lancet or cutter for puncturing the cloth. 2d, Mechanism applied to the lay and the cutter, for moving said cutter towards and into the cloth, and afterwards instantly out of the cloth, such mechanism being the slide, the ratchet, the bar, (with its tooth,) and the spring. 3d, Mechanism for moving the slide bar into and out of the path of the stud of the lay, as specified, such mechanism being the bar, the notched wheel, the gear wheel, the single toothed pinion, the worm gear, the screw, and the wheel, as applied or connected together, and operating substantially as described. I also claim arranging the lance or cutter on the breast beam, and close to the edge of it, where the cloth is bent downwards, the cloth roller, and when such lance or cutter has mechanism applied to it, and operated by the cloth and the lay, so as to put the said lance or cutter into operation, as specified; such arrangement of the lance or cutter on the breast beam, and in close proximity to its rear upper corner, enabling the lance or cutter to pass freely through the cloth, without danger of the latter being sprung away from it by the force of the blow and resistance of the cloth, as will occur when the lance is situated below the breast beam, and become worn or dulled."

32. For an *Improvement in Warping and Dressing Yarns;* Samuel T. Thomas and Eliza Ann Everett, Administratrix of Edward Everett, dec'd., Lawrence, Mass.

Claim.—"What is claimed is, 1st, Warping and dressing yarns directly from small spools or bobbins, instead of large section beams heretofore used, to sectional loom beams, for the purpose of securing a uniform tension in the yarns wound upon the loom beam, and also affording greater facilities for readily producing a variety in the stripe of the fabric. 2d, The fan cylinder for drying the yarns, composed of slats arranged with spaces between them, and around which slats the yarns are made to pass, revolving fans being arranged within the said cylinder, and revolving independently of and at a much more rapid rate than said slotted cylinders, whereby a large portion of the yarns are kept in a gentle current of air, and rapidly dried."

33. For an *Improvement in Fastening Lanterns;* Charles Monnin and William M Booth, Buffalo, New York.

Claim.—"We claim the application to lanterns of the cylindrical or hollow ring, inclosing one or more metallic clamps or dogs, which move horizontally through apertures into a groove."

34. For an *Improvement in Car Wheels with Independent Flanch and Tread;* Wm. S. McLean, Pittsburgh, Pennsylvania.

Claim.—"I do not claim the separate and independent flanch and tread, as that has been patented or described by James Jones, William Howard, and others; but what I do claim is, the wheel with the flanch and tread capable of separate action, when they are made to interlock and naturally support each other, so as to prevent any strain tending to separate them from being thrown entirely upon the journal."

35. For a *Threshing Machine;* William M. Palmer, Palmyra, Maine.

Claim.—"I claim the combination of the screens with the chutes, for screening and separating the grain, as set forth."

36. For an *Improvement in Moulds for Cement or Earthen Tube;* Bradford S. Pierce and Charles M. Pierce, New Bedford, Massachusetts.

Claim.—"I claim the combination of a core and spring case, substantially as set forth."

37. For an *Improved Dumping Car;* Alexander H. Petsch, Charleston, S. Carolina.

Claim.—"I claim the construction of railways laterally across the carriage, or otherwise, by which means I am enabled to dump the boxes by their own gravity, when let go from the apex of the plane, without labor to the operator. Also, the projection of the railway beyond and outside of the car carriage, by which means I am enabled to dump the boxes at such an angle as to discharge their contents, whatever may be the character of the load."

38. For a *Self-Loading and Dumping Cart;* Sanford Stone, Kirkersville, Ohio.

Claim.—"I claim, 1st, Arranging the cart body with a scraper on its fore end, and so as to tilt forward to the ground, for the purpose of scraping up the earth and loading itself immediately from the ground by its own action. Also, the employment of an endless horizontal belt for and in the place of the bottom of the cart body, so arranged and operated by any suitable means that it will be made to revolve in the proper direction during the time of loading and unloading the cart, but will not act while drawing the cart from place to place, for the purpose of assisting the operations of loading and dumping. Also, the combined arrangement of the cart body with the fulcrum or centre on which it tilts, (at a suitable distance from the revolving axle of the cart,) the driving cog wheels on said axle, and two pinions placed upon the shafts, by which the endless belt is driven, in such a manner that the forward pinion will play into said cog wheel when the cart body is tilted forward for loading, and the hind pinion play therein when the cart is tilted backward for dumping, but when in a horizontal position, neither pinion will be geared therewith, for the purpose of operating the endless belt when and only when required. Also, the combination and arrangement of the rack on the cart body, the pinion on the draft frame playing therein, the ratchet wheel on the pinion shaft, and the two clicks on opposite sides of the ratchet wheel, in such a manner that the cart body may be tilted to any position, and immovably held there."

39. For a *Method of Cleaning and Feeding in Grain to the Mill Stones;* Simon Shearman, Goshen, Indiana.

Claim.—"I claim the method of cleaning and feeding in the grain to the mill stones, by passing it through a cleaning apparatus, which is placed in between the hopper and stones, and driven by the stones."

40. For an *Improvement in Saw Mills;* John Stull, Philadelphia, Pennsylvania.

Claim.—"I claim, 1st, A swinging frame, or its equivalent, carrying a circular saw, so constructed and arranged that the saw may be made or allowed to cut its full depth in crooked as well as straight logs. 2d, The revolving self-acting wedge, hung or arranged so as to vibrate and accommodate itself to any crooks, curves, or inequalities in the log or stuff sawed. 3d, The floats or scrapers hinged to the carriage, or their equivalents, to push the saw dust in such direction as may be desired. 4th, I am aware that guides have been used to steady circular saws where they passed out of the log after cutting the score, and also where they enter a score already cut by the saw; therefore, I make no claims to guides used under such circumstances; but I believe guides have never been used prior to my invention, to steady and support circular saws, where they enter and cut the log as they enter. I therefore claim a circular saw, in combination with guides, so arranged as to steady and support the saw where it enters and cuts a score in the log, to prevent the saw from being swerved by knots, cross-grained, or hard places in the wood sawed."

41. For an *Improvement in Shoe Horns;* Lewis Schwingrouber, City of N. York.

"The nature of my invention consists in the use of a spring clasp, in combination with the shoe slip, by means of which the back of the shoe is securely held while being put on to the foot, and the metallic slip guides the heel down into place, the same as an ordinary shoe horn or slip."

Claim.—"I claim the spring clamp with its concave holding jaw, in combination with the shoe slip."

42. For *Improved Tires for Carriage Wheels;* George Souther, South Boston, Mass.

Claim.—"I claim the employment of tires of india rubber, or equivalent elastic material, inserted between projecting flanches, and projecting beyond said flanches, in the manner set forth. Also, using for said elastic tires an entire ring, to be stretched over and sprung between the flanches, in the manner set forth."

43. For an *Improvement in Fire Arms;* Eli Whitney, Whitneyville, Connecticut.

Claim.—"I claim the method of constructing the shear and lock bolt in one piece, combined with the method of operating the same by the trigger and spring, so that the sear cannot release the hammer, except when the chambered breech will be firmly locked in its proper position. 2d, Also, the combination of the trigger with the spring and the lock bolt, (when the lock bolt is of the same piece as the sear,) for locking the chambered breech and discharging the pistol. 3d, Also, the combination of the three springs (when

they are all secured with one screw,) with the catch lever, trigger, and the lock bolt and sear."

44. For an *Improvement in Cleaning Top Cards of Carding Machines;* H. Woodman, Biddeford, Maine.

Claim.—"I claim the combining of lifter cams and a brush bar with one rotary shaft, so that by the movement of such shaft, in the manner specified, the operations of raising and depressing a top card and cleansing it may be effected."

45. For an *Improvement in Bedsteads;* Simon Willard, Cincinnati, Ohio.

Claim.—"I claim constructing the bedstead of sheet metal posts bent longitudinally at right angles, to which are secured transverse flanches, and of a sheet metal sustaining box or boxes, which is supported at its corners by said flanches, and secured in place by rods passing down through both the flanches and sustaining box."

46. For an *Improvement in Fire Engines;* Albin Warth, City of New York.

Claim.—"I claim the arrangement and combination of a horizontal pump with a series of pinions and cranks, as described, by means of the long double rack and spring, attached cross heads, and platforms."

47. For an *Improvement in the Manufacture of Brooms;* William B. Walker, Bennington, New Hampshire.

Claim.—"I claim the process of manufacturing brooms or brushes by compressing the material and forcing it into a chamber, while in a compressed state, and securing it there by means of the clip, or other device, whereby the same end is obtained. That the material may be compressed by other devices than as described above, I am conscious, from experiment; therefore, it is the principle, practically carried out, which I wish to secure by letters patent, as well as the device by which it is done. The spring-catch and tongs, mentioned in my caveat filed, I consider as unnecessary."

48. For an *Improvement in Harrows;* Wm. Anderson, Ulysses, New York.

Claim.—"I claim inserting a tooth in each hinge, so that no part of the ground escapes being pulverized, whereas, in other harrows with hinges, a large space in the centre of the harrow escapes."

49. For an *Improvement in Lasting Instruments;* Thomas Dougherty, Erie, Penna.

Claim.—"I claim so constructing the machine that when drawn up I have ample room for putting in the tacks or pegs, and having a heel which serves as a fulcrum, so that by pressing back the top of the machine I am able to raise the entire jaw clear of the sole, and prevent the jaws from ruffling up the inner sole."

50. For an *Improvement in Cultivators;* Charles K. Farr, Auburn, Mississippi.

Claim.—"I do not claim any of the parts of my implement which are found in the cotton scraper, patented by Wm. C. Finney, April 24th, 1849; but I do claim the hollow standards cast with the ground plate, for firmly uniting the beam to the implement by means of bolts passing through said standards."

51. For an *Improved Hydraulic Press;* Robert Grant, City of New York.

Claim.—"I claim the combination of a flexible water and air-tight bag or medium of vulcanized india rubber cloth with an outside wire vessel, or its equivalent, in such manner as that when water or steam shall be forced into the inside of the bag, the bag or medium shall be thereby pressed outward, and any material contained between the same and the extraneous wire cylinder, shall thus be wrung or squeezed nearly dry by being pressed against the interstitial holes."

52. For *Improvement in Ploughs;* John S. Hall, Manchester, Pennsylvania.

Claim.—"I do not claim the mere hinge joint of the mould board, formed of similar sized stubs, as that is the subject of a patent granted to me, 7th February, 1854; but what I claim is, the dissimilar sized hinges, as described, causing the wings of the mould board to raise in proportion to their expansion, in connexion with the curved hinged braces sustaining said wings at their expansion, and admitting of extreme contraction,

without destroying the requisite form of the mould board under all its changes, (a requisite hitherto not attained,) for the purpose of adapting the plough to a variety of work or uses. I also claim the effectual securing of an iron beam to an iron standard, by means of the inclined segmental slot and bolt or nut, or their equavalent, operating in the manner described."

53. For an *Improvement in Horse Power Hoisting Machinery;* Abraham Jackson, City of New York.

Claim.—"I claim the arrangement of the shafts with their hoisting drums so combined by shifting clutches and gearing that the various operations for the hoisting and lowering of goods into or from ships, warehouses, &c., may be effected by a horse, or other power acting continually in one direction."

54. For an *Improvement in Machines for Cleaning and Drying Grain;* Horatio N. Black, Philadelphia, Pennsylvania.

Claim.—"I claim the employment of the inclined perforated cylinder for drying grain by the action of centrifugal force, in combination with the above described apparatus for cleaning the grain."

55. For an *Improvement in Screens for Hulling Clover Seed and Cleaning Grain;* M. H. Mansfield, Ashland, Ohio.

Claim.—"I claim constructing a screen for cleaning clover seed and the various kinds of grain, in several sections jointed together, when made independently adjustable at each joint, for the purpose of facilitating or retarding the passage of the straw, chaff, and other impurities over it, according to their nature or condition."

56. For an *Improvement in Cultivators;* D. W. Shares, Hamden, Connecticut.

Claim.—"I do not claim, of themselves, the expanding and contracting wings, as such have before been used in corn ploughs and cotton scrapers; but I do claim providing the expanding and contracting hoeing wings on either side with cultivator teeth projecting downwards on the inside of the hoeing wings or scrapers."

57. For an *Improvement in the Cap or Withe for the Masts of Vessels;* Jas. W. Sikes, Plymouth, North Carolina.

Claim.—"I claim the constructing of a withe with a main bar and shackles, so that one withe will serve all the purpose of the two heretofore used, and so that all its wearing or chafing parts may be removed and replaced by others, without disturbing it on the mast, as set forth."

58. For an *Improvement in Felt Hats;* John W. Whittal and William W. Pendleton, Greenwich, Connecticut.

Claim.—"We claim the formation of hats from felt cloth in sheets, combined with gutta percha also in sheets, said materials, after being united, to be formed into shape by pressure in a mould or upon a block, while the gutta percha is in a plastic state."

59. For an *Improvement in Machines for Planing Metals;* Dustin F. Mellen, Wentworth, New Hampshire, Assignor to self, and to John F. Augustus, Somerville, and Samuel A. Eaton, Boston, Massachusetts.

Claim.—"I claim the circular table, constructed and operated as set forth, the rotary motion of the table being dependent upon the longitudinal motion of the carriage."

60. For an *Improvement in Seed Planters;* Wm. Bullock, Assignor to Barton G. Morss, Red Falls, New York.

Claim.—"I claim, 1st, The seeding wheels, formed so that the seeds pass in at or near the centre of the wheels, and out at the periphery. 2d, The arrangement of one and the same wheel for sowing in drills and planting in hills. 3d, The arrangement of the tubes. 4th, The guards in combination with the seeding wheels. And, 5th, The marker for the purpose of indicating the position of each hill, thereby enabling the operator to plant in hills, forming rows both ways across the field."

MECHANICS, PHYSICS, AND CHEMISTRY.

On the Results of a series of Experiments on the Decomposition of Water by the Galvanic Battery, with a view to obtain a constant and brilliant Lime Light. By the Rev. N. J. Callan, Prof. of Nat. Philos. in the Rom. Cath. Coll. Maynooth.*

Continued from p. 209.

To determine the smallest number of cells of the cast iron battery which are as effective as any larger number in decomposing water, I measured the quantity of the mixed gases produced in two minutes by 3, 4, 5, 6 and 12 cells, and also the deflexion of the needle produced by the current from each battery when it passed through a solution of carbonate of soda in which there was about an ounce and a half of soda to each quart of water.† From the steadiness of the needle, it was evident that the current from each battery was perfectly constant during the two minutes it was allowed to act. The quantity of the gases produced by 3 cells was less than three-fourths of the quantity produced by 4, and less than half the quantity produced by 6.

Hence 3 cells are not as effective as 4, 5 or 6. The quantity of the gases produced by 3 cells was sensibly less in proportion to the sine of the angle of deviation shown by the sine galvanometer, than it was when 4 or 5 cells were employed. Hence it appears, that, for want of sufficient intensity, a sensible portion of the electric current produced by 3 cast iron cells passes through a solution of carbonate of soda without producing decomposition; and therefore in decomposing water, 3 cells cannot be used with advantage. On one occasion the current was sent from 3, 4 and 6 cells, through a solution of sulphate of soda mixed with some carbonate of soda. The quantity of mixed gases was very nearly in proportion to the number of cells and to the sines of the angle of deviation shown by the sine galvanometer. The sine of deviation appeared to be a little less, in proportion to the quantity of the gases produced, with 4 than with 3 or 6 cells. In this case, the sulphate of soda as well as the water was decomposed; for when the flame of the gases was thrown on lime, the bright white light produced by the oxhydrogen flame was surrounded by another dim light of a purple hue. With the solution of carbonate of soda alone, the quantity of the gases produced by 4, 5, or 6 cells appeared proportional to the number of cells and to the sines of deviation. Hence, cast iron batteries of 4, 5, or 6 cells will be equally effective in producing decomposition. But a battery of 4 cells will work as long and a half with a given charge as one of 6 cells, and as long and a quarter as one of 5; because in these batteries the quantity of electricity constantly flowing through each cell is proportional to the number of cells. Hence in preparing a battery for decomposing water, all the cells should be arranged in rows of 4 each. Four cells produced more than half the

* From the Lond., Edin., and Dub. Philos. Mag., Feb., 1854.

† The quantities of the gases produced by 1 or 2 cells were so small, compared with that which was produced by 3 or 4, that I did not measure them.

quantity of the gases produced by 12 cells of the same size. A battery of 60 cells, arranged in one series, after having worked for some time, produced in one minute very little more than 4 cells of the same size. I have not yet tried the decomposing power of a battery of a larger number acting in one series; but I shall have occasion, in the month of February, to show to my class a battery of about 250 cells; and I will then measure the quantity of the gases produced in one minute when all act in one series. Eight cells, arranged in two rows of four each, so that the two end zinc plates were connected as one, and the two iron cells also acted as one, produced considerably more of the mixed gases in two minutes than was produced by 12 cells of the same size acting in one series. The quantities of the gases produced by the 8 and the 12 cells were in the ratio of $11\frac{1}{2}$ to 9. But with the 12 cells, the sine of deviation shown by the sine galvanometer appeared to be greater in proportion to the quantity of the gases produced than when the battery of 8 cells in two rows was employed. Hence it would appear, that when the intensity of the current is much greater than that of 4 or 6 cells of the cast iron battery, the ratio of the quantity of water decomposed to the quantity of electricity passing though it is diminished; and consequently that Mr. Faraday's law of definite electro-chemical decomposition does not hold for powerful currents, which differ much in their intensity. In my last experiments I perceived a defect in the magnetic needle employed, and therefore do not feel myself warranted in drawing a positive conclusion. Besides, I am sure that my experiments were not made with as much accuracy as Mr. Faraday's were; but they incline me to believe that the decomposing power of strong currents decreases when their intensity increases. I am inclined to believe that there is a certain intensity above and below which there is a loss of decomposing power; and that, in a cast iron battery, it is the intensity of 4 cells in one series. I am inclined to think that, when the intensity is greater than that, some of the electricity passes through water without meeting the resistance or re-action necessary for decomposition; and that the greater the intensity the greater the quantity which passes without the required resistance. The current from a battery of 12 cast iron cells does not meet with much resistance in passing through a solution of carbonate of soda. For when the current was sent, without passing through the fluid, through the coil of the tangent galvanometer, it produced a deflexion of 69°; and when sent first through the fluid and then through the coil, the needle was deflected to 68°. When a current was sent from 60 cells, first through the fluid and then through a pair of coke points, the deflexion was the same as when it passed through the coke points without passing through the fluid. Hence a current from a battery of 60 cells appears to meet with as little resistance in passing through a fluid as in passing through a wire. Hence a current of very high intensity experiences little or no resistance or re-action from the fluid, and therefore can produce little effect on it.

In comparing the deflexion of the needle produced by a current from 6 cells through a solution of carbonate of soda, with the deflexion produced by the current from the same battery sent directly through the coil of the galvanometer, it occurred to me that if 12 cells were arranged

in two rows, and the two end zinc plates connected as one, and the two iron cells connected so as to act as a single cell, the current from these two rows would, after passing through a fluid, produce a greater deflexion of the needle than they would, if, whilst they acted in one series, the current were sent directly through the coil of the galvanometer. Subsequent experiments proved that my conjecture was well founded. When 12 cells were arranged in two rows of six each, and the current from both was sent through a solution of carbonate of soda and then through the coil, a deflexion of 67° was produced in the needle of the tangent galvanometer. When the current was sent from the same 12 cells acting in one series through the coil alone, the deflexion was only 64°. Hence more electricity passed from the two rows of six each through the fluid, than from 12 cells through the wire. Now it is well known, that when a current of electricity passes from one end of a battery to the other through a conductor in which it meets no resistance, the same quantity will pass in a given time between the ends of the battery, whether it consist of a single pair, or of a hundred or of a thousand circles, or of any number whatever. Hence more electricity will pass in any time through a solution of carbonate of soda from 12 cells arranged in two rows of six each, than will pass in the same time through a wire or fluid from a thousand, or any number of cells of the same size. Therefore whether Mr. Faraday's law hold for powerful currents of great intensity, or whether the conclusion drawn from my experiments be just, 12 cells, arranged in two rows of six each, will produce more decompositon in a given time than will be produced by a thousand, or any number of cells acting in one series. I have found, in the same way, that 8 cells, in two rows of four each, will produce as much, or nearly as much, of the mixed gases in a given time as any number acting in one series. Hence, with the common voltameter, a battery of 500 cast iron cells, arranged in rows of four, will produce more than fifty times as much of the mixed gases as it will produce when all the cells are arranged in one series. Besides, when the cells are arranged in rows of four, the battery with a given charge will act about twice as long as when all act in one series; for in the latter case about twice as much electricity passes constantly through each cell as in the former, and consequently the power of the battery is exhausted about twice as soon. Hence, on the whole, with the common voltameter, a battery of 500 cast iron cells arranged in one series will not produce the hundredth part of its full decomposing effect; but with the voltameter I have described, it will, as I have shown, produce its full effect. If a battery of 4 cast iron cells, and another of 1000 or of any number of cells of the same size be similarly charged, the former will, before its power is exhausted, produce as much of the mixed gases as the latter; because the former will produce in each minute as [half much as?] the latter, and it will work twice as long.

I will here mention one of the experiments from which I inferred, that in a voltameter for a battery of a large number of cells arranged in one series, the number of decomposing cells should be about one-fourth of the number of cells in the battery. When the current was sent from 12 cells in series, through 4 decomposing cells and through the coil of the galvanometer, the deflexion was a little less than that which was pro-

duced by the current from 3 cells when it passed through one decomposing cell and the coil. The difference arose from the imperfect insulation of the cast iron cells. But when the current was sent from the same 12 cells through 4 decomposing cells, and then through the helix of an electro-magnet by which a small magnetic machine was driven, the speed of the machine was considerably greater than when the current from 3 cells passed through one decomposing cell, and then through the coil of the electro-magnet. The wire coiled on the electro-magnet was about 50 feet long and one-eighth of an inch thick. The coil of the galvanometer is about 7 feet long and three-eighths of an inch in diameter. The resistance in the latter was insensible compared with the resistance in the former.

The ratio which the acting surface of each electrode should bear to that of the zinc in each circle may be found by putting a pair of large plates into a glazed vessel, and connecting them with the opposite ends of a battery of 4 cast iron cells in each of which the zinc plate is small, so that the current will pass through the coil of the galvanometer. If a solution of carbonate of soda be then gradually poured into the glazed vessel until the needle ceases to recede from the magnetic meridian, that is, until no more electricity is transmitted through the fluid, it will be found that the acting surface of each of the electrodes, which is covered by the fluid, is about an once and a half as the acting surface of the zinc plate in each circle. By pouring the fluid to any height whatever into the glazed vessel so as to increase the acting surface of the electrodes, no increase will be produced in the deflexion of the needle. Hence there is a limit to the conducting power of fluids for electricity of low intensity. A solution of carbonate of soda (no matter how thick and short the column of fluid may be) will not, when interposed between the opposite ends of a nitric acid battery of 4 cells, conduct more than about one-half of the electricity which will be conducted by a short, thick wire connected with the opposite ends of the same battery. In investigating the ratio which the surface of the electrodes should bear to the surface of each zinc plate of the battery, I used solutions of carbonate of soda of different degrees of strength, and found that the conducting power of a solution, which contains an ounce in each quart of water, is very little inferior to that of the strongest solution, whilst it foams far less. If a neutral salt could be found, which, when mixed with carbonate of soda, would prevent its foaming, and would not be decomposed by the voltaic current, sheet-iron plates coated with an alloy of lead and tin would be in every way preferable to platina electrodes. I have tried nitrate of potash, bisulphate of potash, bichromate of potash, sulphate of soda, borate of soda, and chloride of sodium mixed with carbonate of soda. But they were all decomposed by the galvanic current, as was evident from the light which the gases produced. When the current was sent from the battery through a solution containing three ounces of bichromate of potash and five of carbonate of soda in about five quarts of water, there was scarcely any foam, but the light produced by the gases was tinged with red, and not so intense as the oxhydrogen light. The heat of the flame appeared not inferior to that of the oxhydrogen flame. When bisulphate of potash was mixed with carbonate of soda, the light

and heat produced were the same as when bichromate of potash was used. The light was injured much less by mixing bichromate of potash or bisulphate of potash with the carbonate of soda, than by the mixture of any of the other salts with it.

(To be Continued.)

For the Journal of the Franklin Institute.

On the Practicability of a Line of Telegraph across the Atlantic. By Wm. C. M'Rea, Telegraphic Engineer.

The subject of a telegraphic line to connect Europe and America, is one which at the present time, appears to engross the attention of many capitalists and business men, both here, and on the other side of the Atlantic. The fact of the telegraphic cable extended across the Channel, from Dover to Calais, connecting England with France, having worked for a considerable time with perfect success, and the fact that submarine lines from England to various other points on the Continent, have already been carried into successful operation, together with the assurance from a reliable source, of there being a path, as it were, through the ocean from the eastern coast of Newfoundland to the western coast of Ireland, where a telegraphic cable may be stretched and rest upon the bottom, without liability of being in any manner disturbed, places it beyond a doubt, in the minds of many, that the thing is fully expedient, so far as relates to the construction, laying down, and durability of the cable. The most important point, then, which remains to be decided, is, whether or not, the line will work after it is completed.

It is true that an *Air Line* of telegraph corresponding in length to the distance between the points proposed for connecting the Atlantic cable, has been worked, in this country, by the Morse Instrument, in a single circuit, at a time when the ground was frozen, and the air clear and dry; the most favorable circumstances as respects insulation. This, however, was not done with the whole of the galvanic power, located at the two extremities of the line, as must necessarily be, in the line in question, but with the batteries interspersed at distances of a hundred miles, or thereabouts, apart.

I am well aware that, in the opinions of some, this can make no difference, as it will be said that the necessity for having to thus augment the number of batteries along a line, arises from the imperfect insulation of the wires; but I have found by experience on a line of a few hundred miles in length, on the highlands in Mexico, where, for six months at a time, a drop of rain does not fall, and in consequence of which, defective insulation of the wire could not, at such a time, be supposed to exist to any extent, that the line worked better with small batteries of equal intensity, located at the several stations along the line, than with the same amount of battery material combined and located at one point. But let the effect of placing the batteries at the extremities of so long a line, be what it may, there still remains one difficulty, which in the use of a recording telegraph instrument, will not be easily overcome.

Professor Faraday, in some recent experiments made with the submarine and subterranean lines in Europe, found that on the wires of these

lines, the galvanic current is retarded in its action, by the effect of induced currents. By a calculation deduced from said experiments, it will require a little over two seconds of time, for the electric current to cross the Atlantic. It was also found that the lateral induced current, lingers by static force upon the wire, making its electrical action visible after the galvanic circuit is actually broken. Here is a difficulty, which, if not overcome, must render it impossible to work a recording instrument on a submarine or subterranean line of any great length of circuit, for if, on completing the circuit, the passage of the galvanic current be retarded, a blank must naturally appear where a letter or part of a letter is intended. And, again, if the current lingers so that its effect is perceptible after the galvanic circuit shall have been broken, the consequence must be, that when a stroke is made with the key, thereby closing the circuit a sufficient length of time to make a dot upon the paper, a line will appear instead, thus rendering it impossible to form dots, spaces, and lines, according to the will of the operator, as is now done upon the air lines.

Translated for the Journal of the Franklin Institute.

Preservation of Meat.

We translate from the *Annales de Chimie et de Physique*, the following article, taken originally from the *Annalen der Chemie und Pharmacie.* The experiments detailed are at least worth repeating, for if the conclusions of the author be true, the mode of preservation discovered will frequently be very valuable.—Ed.

" *On the filtration of air as a method of preserving organic substances from putrefaction.* By Wm. H. Schröder and Th: de Dusch.

"An organic substance recently boiled with water is preserved from putrefaction by a current of air properly filtered through cotton. This interesting fact has been demonstrated by the following experiments:

"Meat with water was placed in a glass globe closed air tight by a waxed cork, and traversed by two tubes bent at right angles: the first of these tubes reached inside of the globe to a short distance from the meat, and was in communication with a gas-holder filled with water, which served as an aspirator. The second tube was connected with a horizontal one 60 centimetres long, (about 23·5 inches,) 3 cm. (1·2 inches,) wide, and filled with cotton. The outer end of this tube was closed by a cork through which passed a small tube allowing the air to enter.

"A similar globe received the same quantity of meat and water which remained exposed to the open air.

"Things being thus arranged, the water in the two globes was boiled for some time so as to expel the air and coagulate entirely the juices of the meat; then the stop-cock of the aspirator was turned allowing the water to flow out drop by drop, and drawing the air slowly through the tube filled with cotton. The experiment was begun on the 9th of February, 1853, and was continued without interruption until 6th of March. During the second week, the meat and *bouillon* contained in the open globe, had entered into putrefaction, and exhaled an insupportable smell. The other globe was opened at the end of twenty-three days, and the contents found perfectly untainted. Not the slightest smell was noticed,

and when it was heated, the peculiar aroma of fresh and warm boiled meat was perceived.

"The experiment was repeated with the same success from the 20th of April, to the 14th of May; and from them we may draw the conclusion, that meat recently boiled, and the *bouillon*, are preserved without change in a current of air filtered through cotton. The same result is obtained by operating on the yeast from beer, a very fermentable substance as is known. Exposed for twenty-three days in a current of filtered air, the yeast lost neither its smell, nor its sweet taste, nor its slightly acid re-action.

"On the other hand, some experiments were tried under the same conditions for the preservation of boiled milk, and meat simply heated by a sand-bath without the addition of water. These experiments gave a negative result, inasmuch as the milk and the meat putrified as quickly in a current of filtered air, as in the open globes.

"A final experiment was made in the hotest season of the year with boiled meat and *bouillon;* and whether the boiling was not complete, or from other circumstances, these materials were not kept without alteration. This last experiment, however, cannot invalidate the positive results given by the former ones.

"The authors add, that certain spontaneous decompositions of organic substances appear to require for their commencement and completion, only the presence of atmospheric oxygen; such are the putrefaction of raw meat, of the caséine of milk, and the transformation of lactine into lactic acid. In other phenomena of fermentation and putrefaction, it is not only the oxygen which acts, but also certain unknown elements of the air which may be eliminated by heating it, as M. Schwann did, or by filtering it through cotton."

For the Journal of the Franklin Institute.

An Account of some Comparative Experiments made at the Washington, D. C., Navy Yard, April, 1854, *on the ordinary mode of setting Land Boilers, and on the mode patented by* Henry F. Baker. By B. F. Isherwood, Chief Eng., U. S. Navy.

(Continued from page 200.)

Third Experiment.

The third comparative experiment deserving attention, was made at East Boston, Massachusetts, by Messrs. Parrott & Nason, on a boiler set, first, in the "ordinary manner" as approved by Mr. Otis Tufts, a manufacturer of steam machinery, and then in the manner patented by Baker. This boiler was a plain cylinder, 30 feet 6 inches long. It was first set in the manner commonly used in mills in the vicinity, but no information is given as regards the calorimeter, either with the "ordinary" or with "Baker's Setting." In both cases the boiler was heated up several days before experimenting, to thoroughly dry the brick work and avoid any error resulting from the moisture contained in it. Each charge of coal was weighed from time to time, and as nearly as possible, half a charge (70 pounds) thrown in every half hour. The clinker, ashes, and unburnt coal were weighed as removed. The water was also weighed as often as the boiler was fed; it was weighed *previously* to being fed

into the boiler, where it was evaporated under the pressure of the atmosphere with open sefety valves: the quantity and times of filling with water, were made as regular as possible, for the purposes of comparison, and to avoid mistakes. At the termination of the experiment with the "Ordinary Setting," it was altered to the "Baker's Setting" and an experiment conducted with that, in all respects the same as with the previous one. The coal used was the Dauphin County, Pennsylvania, anthracite, in lumps averaging 0·223 pounds. The area of the grate surface was 7·901 square feet, the area of the heating surface way 118·000 square feet, the ratio being as 1·000 to 14·935: the openings between the grate bars were each, 0·0618 feet wide. The following are the data and results, viz.

	Ordinary Setting.	Baker's Patent Setting.
DATA.		
Duration of the experiment in hours and minutes, .	48·30	48·20
Total pounds of coal consumed, . .	3806	3736
" " wood consumed (for kindling,)	74	99
" " ashes, clinkers and unburnt coal made,	1160	1029
" " *fuel* consumed, estimating two pounds of wood equal to one pound of coal, . .	3843	3785½
Total pounds of *fuel* consumed, deducting clinkers, ashes and unburnt coal, ...	2683	2756½
Pounds of fuel consumed per hour, deducting clinkers, ashes and unburnt coal, . . .	55·32	57·03
Pounds of fuel consumed per hour, deducting clinkers, ashes and unburnt coal, per square foot of grate surface, .	7·002	7·218
Temperature in degrees Fahrenheit of the feed water,	56°·9	62°·2
Total pounds of water evaporated from temperature of the feed water, ...	20229	25509
Pounds of water evaporated per hour from temperature of the feed water, ...	417·09	527·77
Temperature in degrees Fahrenheit of the smoke chimney,	255°·2	379°·1
RESULTS.		
Pounds of water evaporated from temperature of feed water, by one pound of coal, after deducting clinkers, ashes and unburnt coal, ...	7·540	9·254
Pounds of water evaporated from temperature of 212° Fah. by one pound of coal, after deducting clinkers, ashes and unburnt coal, ...	8·791	10·737

From the above table it appears, that the evaporation with the "Baker's Setting" was 22·14 per centum economically greater than with the "Ordinary Setting," taking the evaporation with the latter as unity.

Supposing the composition of the anthracite used in this experiment to be the same as that of the anthracite used in the previous experiment, we shall have for the absolute total theoretic evaporation of this coal (14·624×0·9489=) 13·877 pounds of water from a temperature of 212° Fah. per pound of coal; and as the coal contained 5·11 per centum of oxygen and hydrogen, the evaporation of 10·737 pounds of water from a temperature of 212° Fah. by one pound of coal, will be increased to $\left(\frac{10{\cdot}737}{0{\cdot}9489}=\right)$ 11·315 pounds of water from a temperature of 212° Fah. by one pound of *carbon;* which allows a loss of 22·6 per centum for draft, radia-

tion, &c., from the total theoretic evaporation of 14·624 pounds of water from a temperature of 212° Fah. per pound of carbon.

It is evident from the temperatures of the smoke chimney and the evaporations, that the calorimeter with the "Ordinary Setting" must have been *very much greater* than with the "Baker's Setting," for this temperature with the former was 255·2° Fah., while with the latter it was 379·1° Fah., although 22·14 per centum more heat had been extracted from the coal with the latter than with the former. The difference in the temperatures of the smoke chimney can only be explained on the supposition that the calorimeter with the "Ordinary Setting," which gave the lowest temperature of chimney, was so much greater than with the "Baker's Setting," as to allow the heated gases to lose their temperature by a very considerable expansion, rendering a large portion of the heat latent; while the much smaller calorimeter used with the "Baker's Setting," preventing any loss from this cause, kept the sensible temperature much higher and of course effected with it a much greater evaporation. The standard calorimeter with the "Baker's Setting" appears to be from two to three inches between the bottom of the boiler and the last bridge wall; this space is only from one-fourth to one-third of what is used with the "Ordinary Setting," but there is no reason why as small a calorimeter should not be used with the one mode of setting as with the other; hence, so far as these experiments go, they only prove how greatly the evaporation is affected by proportion of calorimeter, and not the determination of any gain in virtue of the "Baker's Setting" *per se*. The temperatures of the smoke chimney in the above experiments are only correct relatively, they cannot be taken for the correct temperatures of the escaping gases; that temperature with such a boiler, every engineer knows would be at least double, but when the heated gases are delivered into a large chimney, larger than the calorimeter of the flue, open to the air, they immediately expand, and a large proportion of their heat becomes latent and insensible to the thermometer.

A comparative experiment was made by "Messrs. Jones & Homer, from the Departments of Engineering and Chemistry in the Scientific School of Harvard University," under the direction of E. N. Horsford, Rumford Professor in the same University, on boilers with the "Baker" and "Ordinary" mode of setting. These experiments are published by Mr. Amory *in extenso*, and they appear to have been carried on with a great attention to minute details; how accurately they were conducted and how qualified the experimenters were for such a task, plainly appears from the fact, that with the "Baker's Setting," an evaporation of 16·431 pounds of water was obtained from a temperature of 212° Fah. per pound of anthracite, the clinker and ashes having been previously deducted. Now, we have already seen, that the absolute total theoretic evaporation per pound of anthracite, the clinkers and ashes being first deducted, is only 13·877 pounds of water from a temperature of 212° Fah., which amount the report of the experimenters exceeds by 18·4 per centum, though it is practically impossible to come within that per centage of the theoretical evaporation under the most favorable type and proportions of boiler. Such experiments it is unnecessary to discuss.

All the foregoing experiments, from the very mode in which they were conducted, must contain a considerable error as regards the evapo-

rative results given. This error makes the evaporation appear to be considerably greater than what it really was, and arises from the manner of conducting it, the steam being blown off into the air through the usual safety valve and escape pipe: the inevitable result of this mode of getting rid of the steam is, that as it rushes out from the boiler through the escape pipe with great velocity, it *entrains* and carries out with it a large amount of solid water in a finely divided state or in the shape of spray; and as the feed-water is measured *before* it goes into the boiler, it is evident, that the more the water is thus foamed or carried out entrained by the steam current, the higher will the *apparent* evaporation be, though the less the real evaporation will be; because an amount of heat has been lost measurable by the difference between the temperatures of the feed-water and the steam, multiplied by the weight of water thus escaping. It is also evident, that the more rapid the generation of steam is, the greater will be the foaming with the same escape pipe; therefore, in a comparative trial thus conducted, the highest evaporator will appear higher proportionally than it really is. Every practical engineer of extended observation is aware of the truth of the foregoing, and that the amount of solid water carried out of the escape pipe of a boiler, with ordinary proportions, when the fires are brisk and all the steam generated is being blown off, averages from one-quarter to one-third of the amount of water fed in.

The experienced engineer knows, also, that with the type and proportions of the boilers used in the foregoing experiments, nothing like the evaporations stated can really be obtained, and that their amounts will suffer a very considerable reduction were the experiment correctly repeated. The only proper mode of conducting such experiments is by working off the steam through a cylinder, and taking, by an indicator, the pressure at the end of the stroke, then calculating the amount of water from the relative proportion between steam of that pressure and the water from which it was generated. This system, though not free from some slight objections, avoids more than any other, the many sources of error incidental to such experimental inquiries.

It is owing to the mode adopted by experimenters on the comparative steam generating powers of different coals, of conducting the evaporation by blowing off the steam into the atmosphere through safety valves and escape pipes of ordinary proportions, which mode gives, as has already been stated, erroneous results, making the evaporation appear too high; that both the comparative and absolute evaporative results obtained from various coals as given by Professor Johnson in this country, and by Playfair and De la Beche in England, not only cannot be depended on, but are notoriously contradicted by the every day's experience of steam boilers on a large scale, and under the ordinary conditions of practice.

Comparative Experiments made by Engineer-in-Chief D. B. Martin, U. S. Navy, at the Washington, D. C., Navy Yard, April, 1854.

As a consequence of the very high results presented in the printed pamphlets of Mr. Amory, and stated to have been obtained from the careful experiments detailed therein, and which have been received above, the Navy Department was urged by him to adopt the "Baker Arches" generally for marine as well as for land boilers, Mr. Amory asserting, not only the superior excellence of such an arrangement, but its

equal applicability to all types and lengths of boiler. Still, as these experiments and statements were presented by an interested party, it was necessary before accepting or rejecting, to verify or disprove them by a *really comparative* experiment, made by a properly qualified government engineer of indisputable skill and integrity. Such an experiment was made at the Washington Navy Yard, under the immediate direction of the Engineer-in-Chief, D. B. Martin, and in the presence of Mr. Amory and a number of Naval Engineers. The results may be implicitly depended on as the truth, both as regards accuracy of observation, and skill in the conduct of the experiments.

The two pairs of boilers used in making these comparative experiments were precisely alike, such portions only of the brick setting being different as were required for the difference between the "Ordinary" and the "Baker" mode of setting. Both pairs of boilers belonged to the No. 2, stationary non-condensing engine of the Yard; one pair being a spre set for use, while the other might be being cleansed or repaired. Both pairs of boilers delivered their heated gases into the same chimney, which is about 20 inches square.

The pair of boilers having the "Ordinary Setting," is represented in Fig. 1. Each boiler is a plain cylinder, 18 feet 6 inches long and 30

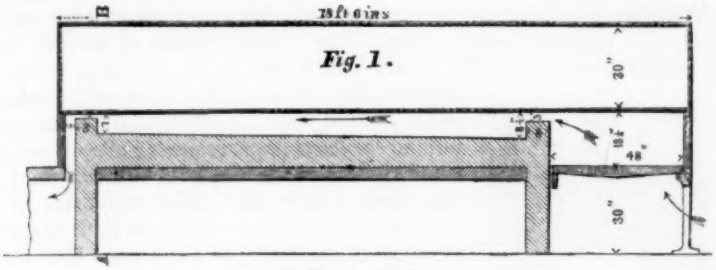


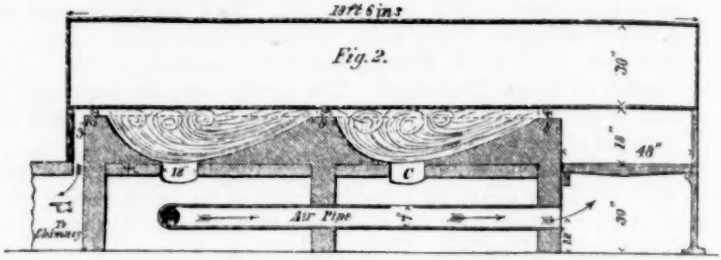
Fig. 1.

Ordinary Setting.

inches diameter, without flues; the distance in the clear between the boilers is 3 inches. There is a bridge wall at each end of the boiler, the height between the bottom of the boiler and the bridge wall at the furnace end is 3 inches, and the calorimeter, or area of opening, is 250 square inches; at the chimney end, this height is $1\frac{1}{2}$-inch, and the area of opening 125 square inches. The atmospheric air for combustion is supplied beneath the grates through the ordinary ash-pit doors at this point, and the arrows indicate the direction of the draft.

The pair of boilers having the "Baker's Setting," is represented in Fig. 2. Here there are three brick bridges, one at each end of the boilers and one equidistant between them; the spaces between these bridges are arranged in an inverted parabolic curve, for the purpose of reverberating the heated gases, in the manner shown in the figure. The distance between the bottoms of the boilers and the bridge walls at the furnace end is 4 inches, at the chimney end 2 inches, and at the intermediate bridge 3 inches. The atmospheric air for combustion, is supplied beneath the grates through an iron pipe 7 inches diameter, with an elbow communicating with the external air; the ash-pit doors in front are tightly

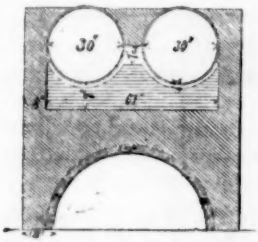
closed up. At the bottom of each parabolic curve, there is a circular opening (C. Fig. 2,) 12 inches diameter, for communicating with the lower closed chamber containing the iron pipes. The arrows indicate the direction of the draft.



Baker's Patent Setting.

In both pairs of boilers, there are exposed to the action of the heat 39 inches circumferentially of the bottom of each boiler, giving the total heating surface for each pair of boilers 117 square feet. The fire grates for each pair of boilers, are 4 feet long by 5 feet broad, giving an area of 20 square feet, or a ratio of grate to heating surface of 1·00 to 5·85.

With the boilers set as above described, the comparative experiments hereinafter detailed, were made. The "Baker mode of setting" was personally directed by Mr. Amory, and was made at the government expense, Mr. Amory being allowed to arrange it as he pleased, and it embraces all of what are termed *the latest improvements;* after it was finished, it was put in use with full coal fires for two days, which fully dried the brick work, and then the trial commenced with the temperature of the water in the boilers 180° Fahr. The weather throughout the trial with the "Baker's Setting" was fine, and favorable for high results.



The other pair of boilers were set in the "Ordinary" manner, by Engineer-in-Chief, D. B. Martin, in the manner approved by him, and shown in Fig. 1. For two days previously to commencing the trial, a small wood fire was kept on these boilers to warm up the water to the same temperature of 180° Fahr., but it was quite insufficient to dry the great mass of wet mortar and brick work. During the three days' trial with the "Ordinary Setting," the weather was fine on the first day, on the second day cloudy in the morning and rainy in the afternoon, and on the third day a very hard rain storm throughout.

The coal used in these experiments was the Pennsylvania Lackawana anthracite, carefully weighed,, very uniform and free burning, giving about 1·33 per centum of clinker, and 8·79 per centum of ashes. The duration of each day's experiment was the same, and nearly the same amount of fuel was fed to the furnaces at the same intervals. Every precaution was taken to make the experiments *strictly comparative*, and as fair as possible.

The steam pressures in the boiler and in the valve chest were taken by the gauge; indicator diagrams were taken every hour, and the steam pressure in the cylinder at the end of the stroke was obtained from them. The calculations of the evaporation were made from the steam pressure in the cylinder at the end of the stroke, taking the number of charges of steam of that pressure furnished, considering a charge of steam to be the bulk comprised between the steam slide and the piston at the end of its stroke, and between the cut-off and steam slide valves reduced to the bulk which would be occupied by an equivalent pressure. This aggregate bulk was one and a half cubic foot, which was the quantity of steam used per single stroke of piston. In calculating the evaporation, two pounds of wood are taken to be equivalent to one pound of coal.

The diameter of the engine cylinder was $9\frac{1}{8}$ inches; the stroke of piston, 36 inches; space displacement of piston per stroke, 1·363 cubic foot; steam cut-off at in cylinder, 10 inches from commencement of stroke.

The following Tables, numbered 1 and 2, exhibit, respectively, the data and results, viz:—

TABLE 1.—*Containing the Data of the Comparative Experiments with the "Baker" and "Ordinary" modes of Setting Boilers, made at the Washington, D. C., Navy Yard, April,* 1854.

DATE.	Duration of the trials in hours and minutes.	Number of double strokes of piston made during each trial.	Steam pressure above the atmosphere in lbs. pr sq. in.			Fuel consumed.				Temp. of feed water in ° F.
			In boiler per gauge.	In valve chest per gauge.	In cylinder at end of stroke per indicator.	Total pounds of coal put into the furnaces.	Total lbs. of wood put in furnaces.	Lbs. of ashes, clinkers, and unburnt coal remaining.	Lbs. fuel consum'd, estimating 2 lbs. of wood = 1 lb. coal, and deducting the ashes, clinkers, and unburnt coal.	
					Baker's Setting.					
Ap. 10,	10 5	27174	55·70	48·05	5·73	803	410	230	793	138°
11,	10 0	26464	53·75	47·40	6·63	889	274	259	767	138°
12,	10 0	26000	54·16	48·20	6·48	867	274	244	760	138°
Totals,	30 5	79638				2559	988	733	2320	
Means,			54·34	47·76	6·37					138°
					Ordinary Setting.					
Ap. 13,	10 0	25304	54·03	48·50	6·78	837	440	201½	885¾	138°
14,	10 0	26212	57·81	52·84	6·53	879	274	247	769	138°
15,	10 0	26746	53·68	49·41	5·97	889½	274	255	771½	138°
Totals,	30 0	78262				2605½	988	703¾	2396¼	
Means,			55·83	50·90	6·45					138°

TABLE 2, *Containing the Results of the Comparative Experiments with the Baker and Ordinary modes of Setting Boilers, made at the Washington, D. C., Navy Yard, April,* 1854.

DATE.	Absolute Evaporation.				Economical and comparative evap'n.			
	Cubic feet of steam evaporated during each trial.	Volume of steam compared with volume of water from which it is generated, the latter being unity.	Cubic feet of water evaporated from a temperature of 138° F., during each trial.	Pounds of water evaporated from a temperature of 138° F., during each trial.	Lbs. water evap'd from temp. 138° F by 1 lb. fuel, 2 lbs. wood = 1 lb. coal.		Relative economical efficiency of the evaporation by the fuel.	
					Ashes, clinkers, and unburnt coal not deducted.	Ashes, clinkers, and unburnt coal being deducted.	Ashes, clinkers, and unburnt coal not deducted.	Ashes, clinkers, and unburnt coal being deducted.
Baker's Setting.								
Ap. 10,	81522	1256·92	64·8585	4053·6563	3·9625	5·11180	1·05978	1·10623
11,	79392	1208·17	65·7126	4107·0375	4·0030	5·35468	1·07061	1·15880
12,	78000	1215·82	64·1542	4009·6375	3·9937	5·27584	1·06812	1·14173
Totals,	238914		195·6019	12225·1187				
Means,		1221·43			4·0043	5·26945	1·07095	1·14035
Ordinary Setting.								
Ap. 13,	75912	1200·52	63·2326	3952·0375	3·7390	4·62092	1·00000	1·00000
14,	78636	1213·27	64·8133	4050·8313	3·9870	5·26766	1·06633	1·13996
15,	80238	1243·48	64·5270	4032·9375	3·9288	5·22740	1·05076	1·13125
Totals,	234786		192·8665	12054·1563				
Means,		1217·35			3·8891	5·03043	1·04014	1·08862

From the above tables it will be perceived that the "Baker's Setting" was 4·75 per centum economically better than the "Ordinary Setting," taking the latter as unity; but it is evident that when the more unfavorable state of the weather during the experiments with the "Ordinary Setting," and particularly the more moist condition of the brick work, are considered, as well as the trifling errors inseparable from all experimental inquiries, it is impossible to conclude other than that the two modes of setting are equally efficient, and consequently, no advantages are to be derived from the Baker arches.

The influence of the moist brick work is very sensibly shown by comparing the results of the first with the second days' trial, in the two cases. With the "Baker's Setting," the brick work being better dried at the commencement than with the "Ordinary Setting," the second day's trial gave 4·75 per centum better result than the first day's trial; while, with the "Ordinary Setting," the second day's trial gave 14·00 per centum better results than the first day's trial.

If the results from the first day's trial in both cases be omitted, and the

comparison be made for the last two days only, it will be seen that the two modes of setting gave very nearly the same results, being expressed by 1·15026 for the Baker, and by 1·13560 for the Ordinary; and this, in my opinion, is the proper comparison to be received.

The reader will not fail to observe the very great difference between the *absolute* evaporation obtained in these experiments, and in the experiments previously discussed, published by Mr. Amory. In the experiments of Mr. Martin, although the proportion between the heating and grate surface was more unfavorable to high evaporative results, than in the experiments offered by Mr. Amory, yet the combustion was exceeding slow, averaging only about 5·1 pounds of fuel per square foot of grate surface per hour, and the calorimeter small, and the coal excellent; hence, it will be seen that the results given in Mr. Amory's experiments cannot be the *true evaporation by the fuel*, but must express, in addition to that evaporation, the amount of water entrained by the steam current up the escape pipe, and thrown out of the boiler in the solid state.

In the Navy Yard experiments, an attempt was made to ascertain the temperature of the escaping gases of combustion as they passed over the last bridge wall, by means of a mercurial thermometer, graduated up to 540° Fahr., but the glass tube broke by the expansion of the mercury within, showing the temperature to have been far above the highest graduation limit.

For the Journal of the Franklin Institute.

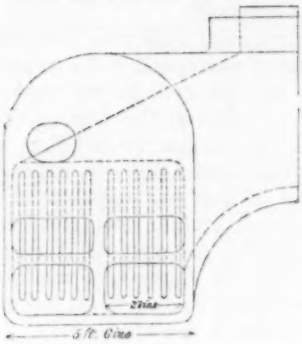
Notes on the Application of Lamb & Sumner's Boilers to the U. S. Steamer Vixen. By Wm. H. Shock, Chief Eng., U. S. N.

During the year 1851, the Bureau of Construction, Equipment and Repairs, were induced to adopt a plan of boiler (known as the Lamb & Sumner Patent) for several of our Naval Steamers, among which we mention the *Alleghany*, *Princeton*, *Massachusetts*, and *Vixen*. The general design of the boilers was the same in all, the only difference being that rendered necessary by the variation in size of hull, engines, &c.

The *Princeton*, after a serious delay of several months, was finally completed, (being the *first* of the number furnished with these boilers,) and left Baltimore for Norfolk, to join the Japan Squadron under Commodore Perry, which had also been detained by the *Princeton*, and was then about to sail, when her debut (viz. the trip to Norfolk) developed the mortifying fact that, the Lamb & Sumner boilers were *absolute* and *unequivocal* failures. She was *at once* abandoned for the Expedition, and her place subsequently supplied by another steamer (*Powhatan*).

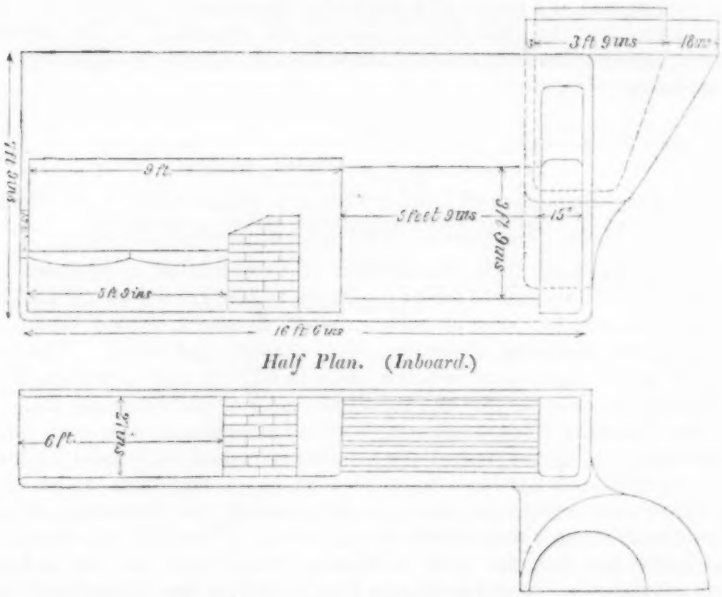
I here leave the *Princeton* for the present, in the hope that a future paper upon the boilers of this ship, which I propose to submit, may at *least* contain some facts of a practical nature that may prove useful as a warning voice (to those who are less able than our liberal Government) not to experiment upon boilers of this class, at least not until we are supplied with accurate drawings of those that are represented as producing such *remarkable* results abroad, with all the attending circumstances, such as sizes of ship, engines, consumption of fuel, &c., &c.

Immediately upon the receipt at the Navy Department of the results of the *Princeton's* debut, the proposed boilers for the *Massachusetts* were abandoned, as the work upon them had not yet been commenced. The work on those for the *Alleghany* also, was suspended, though they were partly finished, until a plan for alteration had been adopted; after which both those for the *Alleghany* and *Princeton* were altered by introducing horizontal tubes. Thus we find, that out of the *ten* boilers of Lamb & Sumner Patent, which were to *revolutionize* our Steam Navy and add so essentially to its efficiency; we have but *two* in existence to remind us of their early contemporaries, and these we find in the *Vixen*, a vessel of the following general dimensions:



Front View.

Side Elevation.



Half Plan. (*Inboard.*)

Scale 3-16*ths of an inch, equal* 1 *foot.*

Length on deck,		118 feet.	
Breadth of beam,		22 "	6 inches.
Depth of hold,		9 "	3 "
Tonnage,	234		
Average draft of water,		7 "	

ENGINES.—One horizontal half beam engine, (Lighthall's patent.)

Diameter of cylinder,	3 feet.	
Length of stroke,	6 "	
Diameter of paddle wheel,	18 "	6 inches.
Length of bucket,	6 "	3 "
Average dip,	3 "	

Her boilers, two in number, are placed one on each side of the ship, with side connexions, as shown in the drawing. Their proportions are as follows:

Whole amount of fire surface,	1450 square feet.
" " grate "	56 " "
Height of chimney from grate bar,	36 feet.
Diameter of " " "	38 inches.
Fuel, bituminous coal, natural draft.	
Ratio of fire surface to cubic foot of cylinder,	34 to 1
" " " grate surface,	25 to 1
" of grate surface,	1·3 to 1

The following abstract was carefully taken from the *Vixen's* steam log during her late cruise in the Gulf of Mexico:

DATE.	Revs.	Steam.	Vac'm.	Throttle.	Cut-off.	Coal.	Saturation.
July 21, '53.	13·4	16·2	24	7 8-10	6-10	546·3	$1\frac{3}{4}$
" 22, "	14·4	16·2	24	$7\frac{1}{2}$	6-10	541·8	$1\frac{3}{4}$
" 23, "	14·8	16·4	$24\frac{1}{2}$	7	6-10	601·9	$1\frac{3}{4}$
" 24, "	14·6	17·2	25	7	6-10	559	$1\frac{3}{4}$
Mar. 4, '54.	12	14·3	28	$1\frac{1}{2}$		484·9	$1\frac{3}{4}$
" 5, "	13·6	12·9	$27\frac{1}{2}$	$1\frac{1}{2}$		470·3	$1\frac{3}{4}$
" 10, "	13·2	12·8	27	1		529	$1\frac{3}{4}$
" 12, "	13	10·8	$27\frac{1}{4}$	1		486	$1\frac{3}{4}$

Remarks.—From July 21 to 24, 1853, light head winds and seas.
" March 4 to 5, 1854, light head wind and smooth sea.
" March 5 to 12, fresh breeze on starboard quarter.

It will be observed, that there is no mention of the speed of the ship in the abstract given, but since my object is only to get at the *merits* of the boilers, that can be sufficiently attained from the particulars furnished. The loss of heat by "blowing" will be found to be about 12·2 per cent., hot well, 115°.

The accompanying drawing has been carefully prepared, in part from actual measurements, and may serve to convey a good general idea of this form of boiler, from which, with the abstract, a very correct estimate of the boilers may be obtained.

For the Journal of the Franklin Institute.

Trial Trip of the Steamship Quaker City. By J. VAUGHAN MERRICK.

The Engineer's trial trip of this ship (for dimensions of which, and particulars of machinery, vide Vol. xxvii, p. 272,) took place on the 6th and 7th September, in the Delaware River and at sea. As the details of her performance are required to complete the account previously given, I shall proceed to state them.

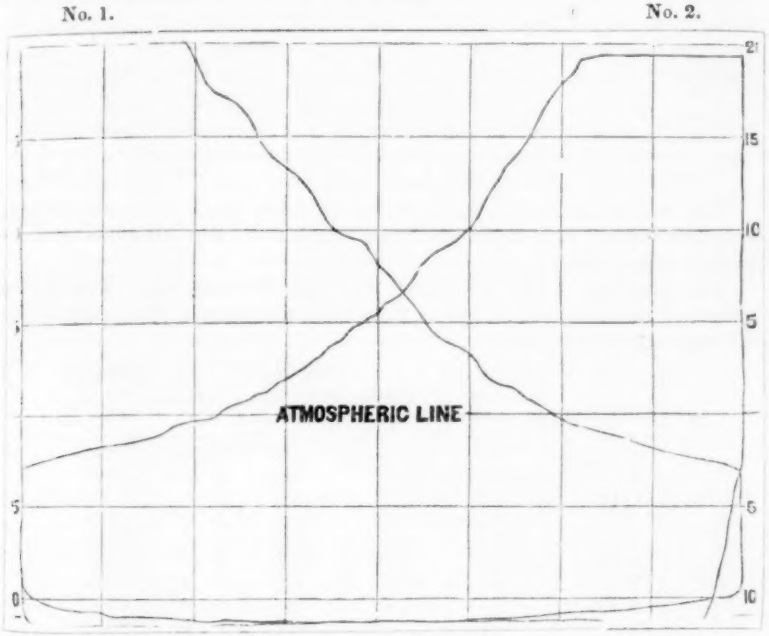
The coal used was Lehigh, no Buck Mountain or other soft anthracite being procurable. The boilers being intended for natural draft, certain descriptions only of anthracite can be advantageously employed as are soft and free burning, giving a long flame. Of these, the kind known as "Buck Mountain" is the best, and will be employed on the regular trips,

while the Lehigh, though well adapted to a forced blast, is unsuitable to boilers with natural draft. The speed of the ship, or steaming capabilities of the boilers, cannot, therefore, be judged of from their performance on the trial; so far as regarded the operation of the machinery, however, it was fully satisfactory. The *Quaker City* has a single side lever engine, with equilibrium poppet valves, and Allen & Wells' cut-off, and with Pirsson's fresh water condenser, constructed with certain modifications not before introduced, which will be hereafter described. There are four return tubular boilers, placed two forward and two abaft the engine, presenting a very large amount of heating surface, (in the aggregate, 7820 sq. ft.,) the object of which was to obtain an abundance of steam in dead calm weather, when the draft is deficient in intensity. The coal bunks occupy the whole length of engine and boiler space, and hold 270 tons, (instead of 180, as previously stated.)

The condenser is placed between the cylinder and air pump, is 7 ft. 10 inches high above the bed plate, 5 feet 8 inches wide athwartships, and 5 feet 4 inches long. The exhaust steam is conducted from the side pipe through a pipe leading around the side rod to the condenser, entering it rather above the middle of its height. The steam passes thence into a copper box bolted to the back tube sheet of the upper range of tubes. This box has a projecting nozzle slipping over a copper gland placed from the outside of the condenser and secured by the flanch of the exhaust pipe. The joint is therefore not perfect between the pipe and copper box. Between this latter and the tube sheet, is a plate perforated with $\frac{3}{8}$th holes opposite each tube, thereby compelling the steam to enter all the tubes simultaneously. Having traversed the upper range, the water and uncondensed vapor enter the "fresh water chamber," comprised between the front tube sheet and the end of the condenser; the vapor uncondensed, returns through the lower range of tubes, which ascend one inch to the lower box beneath the upper one. This box contains a partition extending its whole length and nearly to the top, outside of which the bottom is omitted; so that, while the condensed water returns through the tubes to its chamber, the vapor passes over and mingles with the injection water, becoming finally condensed. In the bottom of the "fresh water chamber" is an opening and pipe leading to two single-acting air pumps, 15 inches diameter and 20 inches stroke, worked from the side lever, which pump the fresh water into a tank overhead, whence it is drawn by four force pumps, each $4\frac{1}{4}$ by 48 inches, each separately provided with a fresh and a salt water feed valve, and each feeding its own boiler. In the upper range there are 1890, and in the lower, 530 tubes, all 1 inch outside diameter, 4 feet long, of copper, 20 ounces to the square foot. The front tube sheet is bolted over a gum joint to a flanch cast on the interior of the condenser; the back ones carry the copper boxes, which are free to slide on supports.

The injection water is introduced over the upper tubes by a large pipe into a strainer box, is thence distributed, and after falling between the tubes of the upper range, is shed off to the sides of the condenser by a shield over the lower or supplementary injection pipes; the latter (being governed by a separate valve,) give fresh cold water to the return or lower range of tubes, and insure a more perfect condensation.

The peculiarity of this condenser, therefore, consists in the return being made *below*, and under injection water not heated by contact with tubes of the upper range. By this arrangement, the condenser is made self-operative; for, in case the fresh water air pumps fail to act, the water rises only above the lower range of tubes, fills them, and flows into the bed-plate through the equilibrium opening in the lower box, leaving the upper range of tubes always free to receive the exhaust steam.



The operation of the condenser on the trial may be seen by inspection of the accompanying indicator diagram, (which is a fac simile of the original, and not in any way reduced or altered).

Conditions of the Ship on the Trial.

Draft forward,	9 feet 9 inches.
" aft,	11 " 6 "
" mean,	10 " 7½ "
Amidship section immersed,	340·5 square feet.
Displacement at that draft,	1474 tons.
Coal on board,	205 "
Dip of wheels at that draft,	5 feet 1 inch.
Diameter of wheels outside of buckets,	31 "
" " inside "	27 " 9 inches.
Effective diameter (of centre of pressure) at that draft and dip,	29·56 feet.
Circumference at centre of pressure,	92·86 "

Performance.—During the upward run, the time of the ship's passing the following points, with all the particulars of performance of the engine

at the same time, were carefully noted, and are given in the following Tables:—

PLACES.	Passed at hours A. M.	Time between, in minutes.	Distance run in statute miles.		Revolutions.			
			By Coast Survey, (Total.)	Deducting for tide; betw'n points.	Total by Register.	Between points. (Register.)	Per minute.	Per mile.
Ledge Light Boat,	6 51				15228			
Delaware City,	9 13½	142½	36·50	31·74	17262	2034	14·13	64·10
Newcastle,	9 36	22½	42·50	5·24	17592	330	14·66	63·17
Marcus Hook,	10 30	54	56·50	12·20	18349	757	14·02	62·05
Navy Yard Shears,	11 49	79	77·00	17·87	19444	1095	13·88	61·30
Totals and means,		298		67·05		4216	14·15	62·87

The tide being favorable, deduction has been made for it, allowing its speed of current at 2 miles per hour, which has been obtained from repeated experiment.

The following Table gives the pressure, vacuum, &c.; it should be remarked that the vacuum given, from the attachment of the gauge, shows the vacuum on the piston:

Time of observation.	Steam in pounds per gauge.	Throttle.	Vacuum in inches per gauge.	Cut-off.	Revs. per min.
6 51 A.M.	20	Half op'n.	24½	2 ft. 3 in.	13·60
7	21½	" "	24⅛	2 3	14·30
7 15	22½	Wide "	24½	2 3	14·37
7 30	23½	" "	24½	2 3	14·45
8	23½	" "	23½	2 3	14·40
8 30	22½	" "	23½	2 3	14·30
9	20	" "	23½	2 3	14·30
9 30	20	" "	24	2 3	14·20
10	21½	" "	23⅜	2 3	14·20
10 30	21½	" "	23¾	2 3	14·25
11	21	" "	23¾	2 3	14·05
11 30	20	" "	24	2 3	13·90
11 45	19½	" "	24	2 3	13·70
Means.	21·4	Wide.	23·8	2 3	14·15

Results.—The indicator diagram from both ends, (No. 1 being the bottom,) is a fair average of those taken during the time for which the foregoing particulars are noted. Boiler pressure, 21 lbs.; vacuum per gauge, 23¾; revolutions, 14½ per min.; hot well, 120° Fahr.; time, 10 hs. 54 min. A. M., Sept. 7. It will be seen that both on the steam and vacuum side, the pressures are fully maintained in the cylinder. The calculated mean pressure for this diagram is 19·25 lbs. per square inch, exerted continually.

Slip of the Wheel.—Total number of revolutions from Ledge Light Boat to Navy Yard, ... = 4,216

Distance traversed by centre of pressure of wheel is, then, 4,216×92·86 . . . . . = 391,507 feet.

Distance run (through the water, after deducting for effect of tide), is 67·05×5280 . . . . . = 354,024 "

Slip = 9·57 per cent., . = 37,483 "

There being no doubt of the correctness of the above data, both as to distance run and the revolutions made, which were carefully noted from the register, the small amount of slip must be attributed to the fineness of the model of the ship, and the large paddle surface immersed.

The model is an improvement over that of the *Keystone State*, by the same builders, which vessel was built from a model furnished by John W. Griffith, Esq., Naval Architect, but necessarily modified somewhat to suit circumstances. The *Quaker City's* model very nearly approaches that originally furnished by Mr. Griffith. Its peculiarities are, sharpness forward, amidship section aft of the centre of length, full after lines, water lines hollow forward, bilge rather square, floor perfectly flat, and carried well forward and aft, and great shear forward.

Resistance of Hull.—The loss by oblique action of the paddles is equal to 18·70 per cent., leaving 81 $\frac{3}{10}$ per cent., of the net power transmitted through the shafts to be applied to propulsion.

Calling A = area of cylinder in inches . . . . . = 5675
P′ = mean pressure on piston, through stroke . = 19·25
P = mean effective pressure, deducting 1½ lbs. for working engine, and 5 per cent. on the remainder for friction of load . . . . . = 16·86
(1—sin.² δ) = per centage of loss by oblique action = ·187
Sin.² δ = (1—·187) . . . . . = ·813
L = length of stroke in feet . . . . . = 8
D = effective diameter of wheel . . . . = 29·56
R = average revolutions per minute . . . . = 14·15
S = slip . . . . . = ·096
C = coefficient of traction.

$$\text{Then } C = \frac{A\ P\ L \sin.^2 \delta}{\cdot 0043\ D^3\ R^2\ (1-S)^2} = \frac{5675 \times 16{\cdot}86 \times 8 \times {\cdot}813}{\cdot 0043 \times 25829 \times 200{\cdot}2 \times {\cdot}817} = 34{\cdot}25;$$

That is, the mean velocity being exactly 13·50 statute miles per hour, or 19·8 feet per second, the power constantly applied to propel the vessel at that speed was $34{\cdot}25 \times 19{\cdot}8^2 = 13432$ pounds, and the horse power exerted was $\frac{13432 \times 19{\cdot}8 \times 60}{33000} = 483{\cdot}77$ horse power.

Proportion of Power Utilized.—The gross power developed by the engine was $\frac{2\ A\ P'L\ R}{33000} = \frac{2 \times 5675 \times 19{\cdot}25 \times 8 \times 14{\cdot}15}{33000} = 749{\cdot}5$ horse power;

Therefore, 749·5 : 483·77 : : 1 000 : 0·645, or 64½ per centum of the gross power was utilized, the distribution being as follows:

	Horses power.	Per cent. of whole power.
Consumed in working engine,	58·40	7·80
" " friction of load,	34·56	4·60
" " oblique action of paddles,	122·00	16·30
" " slip of wheels,	50·67	6·80
" " propulsion,	483·77	64·50
Totals, . .	749·50	100·00

So soon as the ship shall have made a trip from this port to Charleston, burning soft anthracite, I shall publish her steam log, in order to show the steaming capabilities of her boilers.

* Vide Vol. xxiii, p. 412.

For the Journal of the Franklin Institute.

An apparatus for Organic Analysis by Illuminating Gas, and on the use of this Gas in Experimental Laboratories. By CHARLES M. WETHERILL, Ph. D., M. D.

(Continued from page 115.)

On Gas as a source of Heat in the Laboratory.

This agent has become so necessary in the cities where it may be obtained, and its applications are so simple and so self-evident, that a description of the different apparatus for its use seems almost superfluous; nevertheless, the advantage to those who may desire for the first time to employ it, tempts me to communicate the results of my experience.

A very simple burner for table use, and which every one may make for himself, was shown to me about two years ago by Mr. Tilghman, who has employed it for some time. It is simply a spiral of brass tubing of the smallest diameter offered in commerce, and which being closed at one end, is bent to form a spiral with a straight piece of six inches in length at its commencement, and so that the diameter of the spiral (of say three turns) is about two inches and a half. Small holes are drilled at a half an inch apart with a needle in the manner indicated in a former part of this article. The burner thus formed, is surrounded with a cylindrical chimney of sheet brass about eight inches high, held together with five or six rivets, and of such diameter that when the burner is placed in its centre, it shall have a space of half an inch around it for circulation of air to prevent the flames from smoking. Three pieces of two inches and a half high by one and a half wide are cut from the bottom of this chimney, and a small slip of each part thus cut away is left, so that it may be turned up on the inside to support the burner. It thus forms three legs for the chimney to stand upon, and three open spaces for the air to enter from beneath to reach the flame. The top of the chimney is serrated, the points being half an inch apart and forming equilateral triangles; this enables the body to be heated, as a capsule, water bath, &c., to rest upon the top of the chimney, and the hot air and products of combustion are diffused equally upon all sides through the openings thus formed. I have used these burners for some time and find them very practical, giving nearly as much heat as the so-called gas stove, to which they are for most purposes preferable. A platinum crucible placed upon the top by means of a triangle is heated sufficiently for incinerations, which take place slowly, though giving a very white ash. Mr. Tilghman, in certain experiments with which he was occupied, was enabled with such a burner, by using a chimney several feet in length, and placing the object to be heated in the inside, near to the flame, to keep a crucible at a full red heat for several days. Of course the spiral may be made of greater diameter, but the above proportions will suffice for most purposes. The straight end of the spiral is supported by a rest or foot made by bending a piece of sheet brass around it, and receives gas from a vulcanized caoutchouc tube, communicating with the service pipe.

Burner Holder.

A variety of differently shaped burners is often found useful on the laboratory tables, though certain ones are used almost exclusively; it is a

desideratum to be able to change these rapidly without any unscrewing, and above all, when working at night, to be able to get a good light on any of the tables and at any height. I have used for this purpose, a burner stand of the following description, and which seems to accomplish all that can be desired:

A piece of brass tubing of $\frac{5}{8}$ths diameter and $3\frac{1}{2}$ inches long, is closed at the bottom, where, by means of a screw, it may be attached to a circular foot; just above where it is closed, another screw connexion is made with a piece of $\frac{3}{8}$ tube of five or six inches in length, which delivers the gas from a caoutchouc tube, connected with the supply cock. The upper part of the $\frac{5}{8}$ vertical tube is widened and has a cap with a hole in the centre screwed upon it; a cork, perforated to suit the size of the tube which carries the burner, is placed in the top part of the vertical tube, and the cap screwed down tightly upon it. By this means the different tubes which carry the burners, and which tubes are all of exactly the same diameter, ($\frac{1}{4}$ inch external,) may be readily inserted or withdrawn, and admit of adjustment under the object to be heated by a vertical motion through a play of $3\frac{1}{2}$ inches.* It is of advantage to have the lamp thus disconnected from the retort stand which supports the body to be heated, but it is sometimes necessary to have it otherwise, in which case, by unscrewing the foot and the tube, which delivers gas into the burner holder, this tube may be fixed in the clamp sliding upon the retort stand, and the burner holder being again connected, the required object is obtained. The burners usually employed in these stands are the Argand, with a chimney $2\frac{1}{2}$ inches high, formed of sheet brass riveted together. I have found brass better for this purpose than either tinned iron, copper, or iron; some that have been in use for three years, have the surface smooth and not in the least scaled off, though dark in color. When required to raise a crucible to a full red heat, or to heat strongly a florence flask or other object, I convert this burner into a gas stove, by simply placing a piece of wire gauze upon the top of the chimney. It increases the heat, and prevents the disturbing influence of currents of air so troublesome when using the gas stove to rest upon the top of the wire gauze, another chimney of the same size, but cut in points where it touches the gauze to admit air. I find this mode of employing the flame so practical, that I never use the gas stove.

I have tried a variety of differently shaped burners for the mouth blowpipe, but the most effective appears to be one that is known by the name of Solliday's patent, and is a burner proposed for illuminating purposes. The burner is a single cut, and the patent consists in a brass sheath slipping up and down along the nipple of the burner, and which sheath is so cut away as to raise flame upward when it is elevated; it is supposed that it consumes a less quantity of gas for the same light when the sheath is thus raised. The advantage for the blow pipe arises from the base of the flame being very much thickened when the sheath is raised, and the point of the blow pipe rests in the notch of the sheath, thus enabling an

* I have noticed in the last edition of "Quekett on the Microscope," in the Appendix, an achromatic gas lamp for the microscope, which has a stand very similar to the one here described, but with packing in a stuffing box instead of a cork, which prevents the burner being changed without unscrewing.

excellent flame to be obtained, whether for oxidizing, or reducing. The same burner, of course, is used for lighting the laboratory. By means of the burner stand, light may be obtained on any of the tables, with a very few burners; some of these are attached to long tubes (of $1\frac{1}{2}$ to 2 feet) to enable the light to be elevated in the neighborhood of any elevated apparatus that may be in operation, while others are of the usual length of six inches, which brings the light very close to the table. Various burners are used in the burner holder, such as those made from a tube bent into a ring, and with holes made with a needle, for preventing concussion in distilling and evaporating certain substances, for filtering hot, &c. The funnel may be heated for this purpose, by cutting a piece of sheet brass into the shape of a funnel and riveting it together. A circular tube burner, with only four equidistant holes, fits a little above the bottom of this brass funnel, which it heats to any required degree, and also the glass funnel which rests therein. This method is especially suited for small funnels.

The blow pipe table, which is used quite extensively in this city, both in laboratories and in the arts, consists of a square tin box encased in a wooden one, and into which air is forced by a condensing pump worked by the foot. The most convenient tables have a contrivance like that described as the burner holder, which enables the air jets to be readily changed, elevated, or depressed, as may be required.

For fusions with the table blow pipe, the burner is the usual Argand one, the opening of which has fitted to it by friction, a brass cylinder pierced with holes around its circumference; the other end of the cylinder is attached to the brass tube, which slides into the holder delivering air from the reservoir, and the burner is connected with the supply cock by a caoutchouc hose and gallows screw. Where the greatest heat is required, two Hessian crucibles, with the bottoms broken out, serve as a jacket to enclose the platinum crucible.

For glass blowing, I use a burner which answers all the purposes of the ordinary tallow lamp, and with as good effect. It is a flattened cylinder made by brazing together a piece of sheet brass, and is four inches in height. It is fixed vertically to a foot of brass, heavy enough to give it a stable position. It is closed at top by a piece of brass of elliptical shape, and of which the major axis is $1\frac{1}{2}$ inches, and the minor axis $\frac{7}{8}$ths of an inch; this is pierced with seven rows of holes a little over $\frac{1}{16}$th of an inch apart. The bottom of this cylinder is closed, and receives the gas through a short brass tube connecting with the service pipe by a caoutchouc hose and gallows screw. The blow pipe nozzle is made from a tube of difficultly fusible Bohemian glass, of half an inch in diameter, which must be formed by being held in the flame until the sides fall almost together, and then drawn out so that the orifice for the air jet is small, and for a short distance almost cylindrical; this is important to obtain a long flame. The glass nozzle is fitted by a perforated cork to a short brass tube bent at a right angle, and which fits the stuffing box, delivering air from the reservoir. By this means the requisite adjustment of light may be effected, and if the glass tip be properly made, a beautifully pointed horizontal flame, of a foot in length, may be obtained. Of course, by removing the burner a little in advance of the jet, the brush

flame may be formed, and which is of a size sufficient to blow bulbs large enough to determine the specific gravity of vapors by Dumas' method. A jet for giving a larger and more widely spread brush flame for blowing larger bulbs, and bending thick tubes, is made by hammering together (after annealing) the end of a $\frac{3}{8}$ brass tube, and then, filing down the end until a fine slit appears; this is silver-soldered to another tube bent at right angles, which fits the aperture in the jet holder, and so that the slit is in a horizontal plane. The air passes out of the slit across the flame, spreading it out into a wide brush. By means of the blow pipe burner here described, many little articles may be silver-soldered, and I have found the long pointed flame invaluable for blow pipe experiments; thus obviating the inconvenience of the mouth blow pipe. It gives also a very good reduction flame for such experiments.

Cupellation with the Tube Blow Pipe.

Professor Booth states in his *Encyclopedia of Chemistry*,* that by driving the current of air (from the table blow pipe) obliquely and somewhat downward, through the Argand burner, the process of cupellation may be accurately performed on 20 grammes of lead.

The following are the results obtained in cupellation with the gas blow pipe lamp described above.

A hessian crucible, without bottom, is supported horizontally upon a retort stand in front of the burner, and inside, in the middle resting on the side of the crucible, is placed the cupel. The brush flame from the burner, using the slit nozzle, is blown into the mouth of the crucible, where it heats the cupel and is reverberated upon it from all sides. The bottom of the crucible being arched, the flame keeps even the back part of the cupel at a sufficient temperature. It is well to place a fragment of a porcelain crucible in front of the cupel to prevent it cracking by the direct action of the flame. The different circumstances to be attended to in cupelling, are thus entirely under the control of the operator. By regulating the stop cock, which supplies the gas, and by varying the pressure and quantity of the air, the flame may be made oxidating or reducing at will, and the heat may be suddenly raised or lowered as the conditions of the experiment require. This method promises, at least, an equal accuracy with that usually employed, and for one or two experiments, is, I think, preferable. In the second experiment, the cupellation lasted exactly a quarter of an hour from the time of lighting the gas. And thus the per centage of silver in a coin, may be ascertained within about twenty minutes.

The cupellation was performed upon a half dime of 1853, half of which was taken for each experiment. In the first analysis, the lead was taken purposely in excess, to observe the working of the experiment.

First Experiment.

Weight of half the coin, 0·6735 grammes; lead, 7·3; resulting button of silver, 0·602 grammes, or

Silver,	89·384
Copper,	10·612
	100·000

* Article, Blow Pipe Table.

Second Experiment.

The lead was here taken according to d'Arcets' Table. Weight of second half of coin, 0·553 grammes; lead, 3·871; resulting button, 0·49625, or

Silver,	89·738
Copper,	10·262
	100·000

This result comes within 2½ thousandths of the theoretical amount of silver.

Distillation.

The still in my laboratory is heated with gas. It contains seven gallons of water when filled to the proper degree for distilling, and will prepare distilled water at the rate of a gallon an hour, with the burner now in use. This still was originally set in a furnace for being heated with anthracite coal; to prepare it for gas, no other alteration was made than to place a damper in the chimney. The burner is a ⅜-inch brass tube, bent in a circle of 12 inches diameter, and resembling a wheel with eight spokes; the gas entering these where they join in the hub or centre. Holes are drilled along the spokes and around the circumference of the wheel. The gas thus burns in small jets, and the burner is placed in the furnace about 2½ inches distant from the bottom of the boiler. I have never actually measured the gas used by this burner, but I infer from other experiments, that it is within 25 feet an hour, which would make the cost of a gallon of distilled water under five cents. Seven gallons of water begin to boil in almost a half an hour after lighting the burner; and as the heat is equally diffused over the surface of the boiler, the ebullition is quite tranquil, which conduces to the purity of the water. The furnace, besides retaining the heat and saving thereby, enables other boilers to be placed in it for various experiments of distillation, and heated by a stronger heat than gas, if required. For this purpose, the top of the furnace is of cast iron with a circular aperture, in which the boiler fits and is supported by a flanch.

Sand Bath.

The sand bath is also heated by a burner of exactly the same shape and size as for the still. This sand bath was also intended, originally, to be heated by fire, under the fore part of it, and is, together with the wind furnace, enclosed in a cast iron frame, or hood, with windows. The aperture in the bed-plate for the reception of the sand boxes, is 3 feet 3, by 19 inches. In this opening, resting on their flanches, are two sheet-iron boxes for the sand, each occupying the half of it. One of the boxes is plain, the other has a well in the centre, of 12 inches in diameter, formed by a cylindrical piece of the same height with the sides of the sand box, and riveted around a corresponding aperture in the bottom. Around this well is sand, for the reception of small vessels; and a circular sand bath fits in the well, and may be removed to give place to a large capsule, or to a large water or oil bath, which may be required to be submitted to the direct action of the heat. Either of the two sand boxes thus formed being movable, may be placed in front directly under

the source of heat, as circumstances may require. The gas burner is so placed, that when the box with the well is in front, the burner is directly under this well. The heated air passes along a flue, of three inches in height, formed by the bottoms of the sand bath, and slabs of fire tile, which form the roof of an oven, of the dimensions 2 feet 3, by 2 feet 4, by 21 inches in height. At the back of this flue, the heated air may, by dampers, be either passed directly into the chimney, or thrown down into the oven, where it makes the circuit of the floor through square stove-pipes, whence ascending to the roof of the oven, it escapes into the chimney. In this oven is a thermostat for regulating a separate burner, which heats it when the sand bath is not in action, and which is thus independent of it. I have places under the sand bath for two large circular burners, but have found one, so far, sufficient. The heat is sufficient for all purposes to which the sand bath is applied.

For the Journal of the Franklin Institute.

Notes on the Pacific Mail Steamship Company's Steamer "Sonora." By Wm. H. Shock, Chief Engineer, U. S. N.

The above named steamer was lately built and fitted for the Pacific Mail Steamship Company, and adds one more to the number constituting that successful line of vessels in the Pacific, under the management and direction of Wm. H. Aspinwall, Esq., of New York.

In this case (as with all the vessels belonging to this line,) no expense or pains have been spared to make her (for speed, safety, and comfort,) what a traveling community requires.

They have now in successful operation, the following steamers, viz., "*John L. Stephens*," "*Oregon*," "*Golden Gate*," "*Panama*," *and* "*Sonora.*"

The "*Sonora,*" after having made a successful trial trip, left New York for the Pacific, March 11th, 1854, via Rio and Valparaiso, and by reference to the annexed log, nearly all the particulars of her run from New York to Rio will be seen. It is, however, not as full and complete as is desirable, in order to ascertain the real efficacy of the ship, as no mention is made of the extent of opening of the throttle valve, the state of the wind and sea, with its effect upon the working of the ship, and last, but by no means the least important items neglected, were Indicator Diagrams; from which *only*, can the power and efficiency of the engines be satisfactorily determined. Indeed, as it is truly remarked by a writer on the instrument, "In the hands of a skilful engineer, the Indicator is as the stethoscope of the physician, revealing the secret workings of the inner system, and detecting minute derangements in parts obscurely situated;" and it is to be regretted that it is not more generally used; as with it we can determine defects, both in the design and working of the engine, if any exist, and with carefully kept "logs," as well as carefully taken diagrams, with known dimensions of ship, engines, and boilers, a tabulated form of engines, boilers, &c., to the hull, might be established, whose accuracy would be based upon practical observation.

Steam Log of the Steamer Sonora, from New York to Rio Janeiro, 1854.

Date.	Aver. Steam.	Aver. Vac'm.	Aver. Revs.	Aver. Tem. of H. W.	Grade of Ex.	Ashes. Lbs.	Coal. Lbs.	Density of water.		Dip of Paddles.
Mar 11,	14	23	9·4	115	2-5	1,053	17,555	$\frac{1}{8}$	$1\frac{1}{8}$	7 ft. 2 ins.
12,	14	23	9·4	116	"	6,357	40,344	$\frac{3}{8}$	$\frac{3}{8}$	at N. Y.
13,	17	23	10	126	"	11,025	48,152	$\frac{5}{8}$	$\frac{5}{8}$	5 ft. 1 in.
14,	$18\frac{1}{2}$	24	10·9	126	"	5,774	55,143	$\frac{7}{8}$	$\frac{7}{8}$	at Rio
15,	19	$24\frac{1}{4}$	10·3	126	"	4,940	53,777	$1\frac{1}{2}$	$1\frac{1}{2}$	Janeiro.
16,	$19\frac{1}{2}$	24	11 8	126	"	5,800	53,180	$1\frac{1}{2}$	$1\frac{1}{2}$	
17,	$19\frac{1}{2}$	24	12 2	128	"	5,213	45,709	$1\frac{1}{2}$	$1\frac{1}{2}$	
18,	$17\frac{1}{2}$	24	11·6	128	"	5,100	50,903	$1\frac{1}{4}$	$1\frac{1}{4}$	
19,	18	24	12	128	"	5,564	57,222	$1\frac{1}{4}$	$1\frac{1}{4}$	
20,	20	24	12·3	120	"	5,072	48,318	$1\frac{3}{8}$	$1\frac{3}{8}$	
21,	19	24	12·4	128	"	8,848	55,602	$1\frac{3}{8}$	$1\frac{1}{2}$	
22,	20	25	13·3	130	"	9,296	58,012	$1\frac{3}{8}$	$\frac{3}{8}$	
23,	17	25	12	128	"	8,848	52,640	$1\frac{3}{8}$	$\frac{1}{4}$	
24,	$13\frac{1}{2}$	25	13	125	"	8,960	57,648	$1\frac{1}{4}$		
25,	15	25	13·4	126	1-5	8,965	56,848	$1\frac{1}{4}$		
26,	15	25	13·8	128	"	9,074	58,974	$1\frac{1}{4}$		
27,	18	25	13·6	130	2-5	8,968	57,271	$1\frac{1}{4}$		
28,	17	25	13	130	"	9,128	44,422	$1\frac{1}{4}$		
29,	$12\frac{3}{4}$	24	15·4	130	"	20,844	48,865	$1\frac{1}{4}$		
30,	17	24	15·5	130	"	10,082	55,975	$1\frac{1}{4}$		
31,	17	24	16	130	"	9,752	62,680	$1\frac{1}{4}$		
Apr 1,	19	24	15	130	"	10,640	64,000	$1\frac{1}{4}$		
2,	15	23	15	130	"	10,864	55,729	$1\frac{1}{4}$		
3,						7,280	33,000	$1\frac{1}{4}$		

Left New York, March 11th, at 1 o'clock P. M.; arrived at Rio, April 3d, at 9·40 P. M.; whole time, 22 days, 8 hours; running time, 21 days, 23 hours.

Whole number of revolutions,	. .	403,051
" amount of coal expended,	. .	556½ tons.
" " oil "	. .	79 gals. 3 qts. ½ pt.
" " tallow "	. .	60 lbs.
" " india rubber,	. .	25 "
" " waste "	. .	50 "

Remarks.—Owing to our condenser working so well, we found it unnecessary to blow our boilers until we were six days out, when we altered our regulation somewhat, feeding all fresh water in port boiler; surplus of fresh in starboard. We required to blow starboard boiler 22 minutes, on an average, per watch of 4 hours, in order to keep our water at 1½. On examining boilers we found port boiler free from scale; starboard boiler with about 1-32 of an inch of scale. On arriving in port, engines and boilers in good condition.

As regards the working of the patent condenser, I am happy to say it has given every satisfaction. I have also ascertained how long it required to fill our fresh water tank with an average pressure of 19 lbs. of steam, engines making 15 or 16 turns; it took 22 mins. Dimensions of tank, 8 ft. long, 4 ft. deep, and 4 ft. wide. We allowed it to hold 1000 galls.

The "*Sonora*" is a hermaphrodite brig-rigged vessel, of the following dimensions, viz.:

Length on deck,	. . .	270 feet.
" of keel,	. . .	264 "
Breadth of beam,	. . .	36 "
Depth of hold,	. . .	24 "
Tonnage,	. . 1580.	

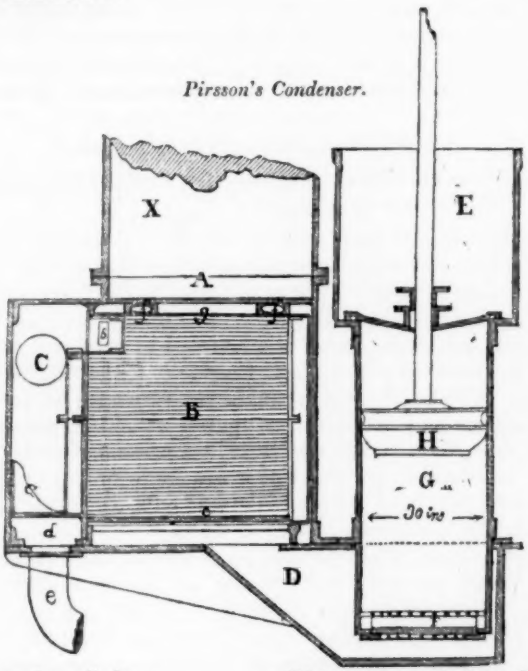
And is supplied with two top beam engines, from the Morgan Iron Works, New York, of the following dimensions:—

Diameter of cylinder,	. . .	50 inches.
Stroke of piston,	. . .	10 feet.
Diameter of air-pump,	. . .	30 inches.
Stroke of air-pump,	. . .	57 "
Diameter of water wheel,	. . .	30 feet.
Face of water wheel,	. .	9 feet 6 inches.

She is supplied with *one* of Pirsson's Surface Condensers, under starboard engine, and an ordinary jet condenser under port, and so connected as both to be worked by one air-pump, if necessary.

It will be observed, that the "Surface Condenser" worked well, and gave entire satisfaction.

Pirsson's Condenser.



A, Flanch to receive cylinder.
B, Tubes.
C, Exhaust pipe.
D, Bed plate channel.
E, Reservoirs.
F, Foot valve.
G, Air pump.
H, Air pump piston.
a, Division plate at bottom of exhaust box.
b, Equilibrium openings.
c, Tubes to conduct fresh water.
d, Fresh water reservoir.
e, Suction to fresh water pump.
f, Injection holes.
g, Strainer for injection.

Her boilers are of the ordinary "up return flue" variety, and gave good results on her trial trip, (natural draft,) but since her arrival in the Pacific, they find that in consequence of the light airs and calms, which prevail on their route near land, much trouble is experienced in getting steam, and this fact presents the best reason for supplying steamers destined to the Pacific, with blowers.

A slight accident occurred to the *Sonora*, on her passage to Panama, while passing through the Straits of Magellen, in consequence of the guard over the foot valve F in bottom of the starboard air-pump being deranged, the air-pump piston-rod was bent, rendering it necessary to disconnect it for a few hours, until the requisite repairs could be completed; during which time, *both engines* were in operation, consequently *both* condensers, with but one air-pump, which performed the work

required for both engines; and strange as it may appear, *the vacuum per gauge showed a diminution of only* $1\frac{1}{2}$ *inches, or an increase of* $\frac{3}{4}$ *lbs. back-pressure*, everything remaining the same as before the accident, as to steam, revolutions, &c.

These remarkable results I conceive to be attributable exclusively to the fact of the air-pump being placed so low down in the channel-way, as seen by the annexed drawing of the arrangements. It also shows in this particular case that the engines are over-loaded with air-pump, although designed accurately to the proportions usually given.

For the Journal of the Franklin Institute.

Thoughts on the Caloric Engine. By Thomas Ewbank, Esq.

(Continued from page 184.)

If any reliance is to be placed on the cardinal doctrines of physics, a mechanical effect can never be repeated at less than its first cost. There are no variations in nature's prices of force; nor is there such a thing as planting a certain amount in a machine, like seed in soil, and reaping from it an increase; yet, that is what is attempted in perpetual motions, and is alleged to be realized in the Caloric Engine. If the allegation, incredible as it is, turn out true, the engine infinitely surpasses all previous acquisitions in science and art; but if it do not establish, what is called its grand principle, the *repetition of force*, we presume it will, from the excitement it has caused, the converts it has made among professional men, including both statesmen, heads of departments, and savans, be associated with kindred hallucinations of former times.

There are axioms in mechanics, as in morals, mathematics, and other sciences, which serve as touchstones; so that propositions conflicting with them, however specious in appearance, may safely be rejected. It needs no process of reasoning to show that two and two make four, nor of experiment to prove that action and re-action are inseparable and equal; and hence, when Captain Ericsson announced that in his air-engine he repeatedly used the same power, many persons at once concluded (since that was equivalent to saying, he obtained action without re-action, and power without cost,) that he was mistaken; and that his error was as gross, though it might not be as apparent, as any of the well known attempts at perpetual motion. If he has not contemplated heat as a source of force irrespective of its vehicle, has he not forgot that force is only available *while re-acting* against some resisting body, and that without this, it must be, to all mechanical purposes at least, latent. A quantity of heat sufficient to overthrow a mountain, might be concealed in a piece of floating down, and yet the force locked up in it could not displace a fly till developed by re-action. A giant standing in the atmosphere, supported, as the saying is, upon nothing, could not lift a tumbler of water from a table, because he would have nothing for his feet to rest or re-act on; and just as impossible would it be to get heated air from the regenerator into a cylinder a second any more than the first time without an external base to start it from. Unless Capt. E. can leave the heat lying *perdu* at the bottom of the cylinder, we do not see how, when once out, it can be got in again without an outlay of force equivalent to it, since it has to be

sent in with air, and the base of re-action for that air is the piston of the feed pump. We may be mistaken, but it does seem as if the law of action and re-action had been overlooked, or that it was thought to be neutralized by, or lost in, the secret phenomena of heat, or that it was rejected along with received doctrines on the mechanical relationship of heat to force.*

The origin of the engine, as given by Sargent, is highly characteristic of it:

"The late Professor *Harvefeldt* of Sweden, one of the first mathematicians of the day, stated, in a public lecture, not many years ago, that there is nothing in the theory of heat which proves that a common spirit lamp may not be sufficient to drive an engine of an hundred horse power. It will readily be believed that the Professor had but few hearers who did not smile at the suggestion; but among those few, we may number ERICSSON, who, from the earliest period of his mechanical labors, had been in the habit of regarding heat as an agent, *which, while it exerts mechanical force, undergoes no change.* This extraordinary fact, ERICSSON exemplifies, by a simple but conclusive illustration; for the readier reception of which, by the audience, it will be well to introduce particular dimensions. Suppose the piston of an ordinary steam engine cylinder to be at the bottom, and suppose the force of the steam intended to be admitted into this cylinder under the piston to act with the force of 100,000 pounds, which is the force on a piston of 50 inches diameter, acted upon steam of 50 pounds pressure to the square inch. Suppose the cylinder to be ten feet long, and the piston to be loaded with a weight equal to these 100,000 pounds. If, now, a sufficient quantity of steam of the stated pressure be admitted from below the piston, this load will be elevated through the whole length of the cylinder; and hence we shall have raised a weight of 100,000 pounds through a space of ten feet. But who will contend that this immense amount of mechanical force has required any *expenditure of heat?* Does not the steam, after having lifted this weight, contain just as much heat as it did before leaving the steam boiler, less only the losses by radiation? And does not that heat retain all the properties *after* the operation which it possessed *before?* Am I, then, incorrect in stating that we have obtained this power without changing the nature, or diminishing the energy of the heat employed?

"But, although nature has furnished us with an agent of such extraordinary properties for the production of mechanical force, how imperfectly do we employ it! In the low-pressure engine we turn the steam, after having performed its good office, into a condensing apparatus, where the heat is in a manner annihilated; and in the high-pressure engine, we throw it away into the atmosphere. Yet men, even of mechanical distinction, ridicule the idea of superseding the steam engine; and science seems to pause contentedly in the contemplation of its admitted perfection." * * * * "From what I have already stated, it will be readily inferred, that the principle forming the basis of the *Caloric Engine*, is that of returning the heat, at each stroke of the piston, and using it over and over again."

Why the fact that heat in a cylinder is the same after as before pushing up a piston should be so conspicuously pointed out as an 'extraordinary' one, we do not see. May not the same be said of every motor? Does wind undergo any change 'whilst it exerts mechanical force' on the sails of a ship? And does not the Croton water 'retain' in the city of New York 'all the properties which it possessed before' it reached, in its rural channel, those grist and factory mills whose wheels it drives round? And if, *because* heat experiences no change in air or steam cylinders, it can be used over and over indefinitely, why not wind and water also? 'Ah!' some one replies, 'because in that case you would have to *carry back* those fluids after they had once acted, and place them in a proper position to do their work over again.' Exactly so, and so must Captain Ericsson with his heat. As respects it, he mistakes quality for position. It will act again when he takes it back and replaces it in

* See postscript, where it appears to be repudiated, and where it is admitted, if it be true, the caloric engine very much resembles the perpetual motion.

a proper condition to act, just as will wind, after driving a windmill, or water, after acting on the piston of a pressure engine; but as with them action and re-action would balance each other, it would take as much power to get it back as it could then give out. Had he, in his early labors, regarded heat as an agent, which, whilst it exerted mechanical force, acted on one body without equally impinging or butting against another, and had he recently proved and exemplified it 'by a simple but conclusive illustration, that would have been truly extraordinary,' *and to the point.*

It is not necessary to be acquainted with all or half the working parts of the caloric engine, to comprehend how the principle it is based on is attempted to be carried out. Let us take one of the four large cylinders standing over its fire,* its feed pump, and a regenerator between them. It will be sufficient to understand the action of these; all else are intermediate links or accessories. Suppose the feed pump set at work by some external force, as it must be at first, and drives a charge of air into the lower part of the working cylinder; the fire beneath expands the air, the piston is then pushed up by it, and motion communicated, as in steamboats, to the crank that carries round the paddle wheels. The piston next descends, driving the heated air beneath it through the regenerator into the open atmosphere. The feed pump, now worked by the engine, drives forward another charge of air, sending it through the regenerator, where it takes up and bears into the cylinder the heat left in it by the previous charge on passing through. The working piston is again raised, again the air escapes through the regenerator, leaving its heat within, and again a fresh charge bears it back to the cylinder, where, receiving an accession from the furnace, the piston is again raised, and so on.

A careful examination of the circumstances attending a few strokes of the working piston, ought to show the truth, if it be in the caloric engine, and if not, to point out where the error lies. We think it will. It has led us to the following propositions and conclusions:

1. The efficacy of the engine is due to the quantity of air dilated within the working cylinder, and to the extent of its dilation; that is, the denser the air injected, and the greater the heat imparted to it, the more power it will have.

2. If unheated air were employed, if neither fire nor furnace were used, the engine would have no power, because no expansion could take place within the cylinder.

3. If heated air were employed, that is, heated before, and not after its injection, the engine could have no more power than with cold air, and for the same reason.

4. Its motion, then, depends on increasing the temperature of the motive fluid *after* it has entered, or virtually entered the working cylinder; no previous expansion can be a clear, or any gain; 1st, Because it is purchased with a corresponding outlay of power on the feed pump, not that a heated charge requires more power to inject it than a cold one, but because there is less air in it. Equal volumes require equal power, but not equal quantities. A charge doubled in volume by heat, would require double the power to introduce it; but, as we have seen, the power of the engine depends on the quantity dilated *within* the cylinder,

* These closely resemble those steam engines in which the boiler and cylinder are combined; the lower part of the latter being embedded in the fire.

not without; 2d, Because heated air undergoes less expansion when it arrives within the cylinder, than if it had not been heated. In other words, the power depends on the quantity taken up *directly from the furnace*, for it is the hot air *in* the cylinder that does the work; the rest, whether in the regenerator, feed pump, receiver, or passages between them, simply serves as a re-acting medium till the cut-off confines the reaction to the bottom of the cylinder. Hence, when the caloric engine ceases to take up *fresh heat* from the furnace, it must cease to give out *fresh power*.

5. As it is said to be possible, let us suppose the *whole* of the heat arrested and returned by the regenerator; the engine would then be a full realization of its author's views, and of those of Harvefeldt. It would demonstrate that a common table lamp would do work equivalent to an hundred horse power, and even more! *i. e.*, its friends would expect it to do this: nothing less would fulfil their predictions. Now, seriously, could it have any power at all? Could it move at all? Beyond controversy, not. As no expansion could take place within the cylinder, just as much power would be required to send a charge in, as it could give out when in. The condition of things would be precisely as in proposition 3.

6. It may, perhaps, be contended that the regenerator is virtually a part of the working cylinder, and that the reasoning about a diminution of injected air, in consequence of its being heated on the way, is fallacious, inasmuch as the feed pump always receives and delivers its full charge of cold air. Admit this, and the aspect of the case is not changed. Because the pump drives forward its contents at every stroke, it does not follow that they all reach the furnace or place of expansion; we know they do not. The regenerator is a capacious chamber, and a quantity of air equal to its capacity and connecting passages, never gets into the cylinder. The cold air sent through the regenerator by the first half of the pump's stroke, bears off to the cylinder the greater part of the heat lodging in the wires; that sent in by the other half takes up less and less, the latter portion probably none, or next to none. Now, unless this last air goes forward to be heated, its presence is of no account. How is the fact? Why, instead of being sent on to the furnace, it is discharged at the end of the stroke; *i. e.*, almost as soon as it enters; consequently without performing any useful service whatever. It constitutes a virtual prolongation of the re-acting base of the feed pump's piston, but that is attended with a loss of power, not a gain. Hence, if the regenerator is virtually a part of the working cylinder, it is an unprofitable one, to say the least, since, upon it is spent, without return, the latter and most efficient part of the feed pump's labors. To it is to be ascribed the difference in quantity between air supplied by the feed pump and that which reaches the working cylinder, whatever that difference may be.

(To be Continued.)

FRANKLIN INSTITUTE.

Proceedings of the Stated Monthly Meeting, September 21, 1854.

John Agnew, Esq., President, pro tem., in the chair.

J. Vaughan Merrick, Esq., Corresponding Secretary, pro tem.

Isaac B. Garrigues, Recording Secretary.

The minutes of the last meeting were read and approved.

Letters were read from The Maryland Institute, at Baltimore, Md., Ayres Stockly, Esq., of Ontanagon, Mich., and Wm. H. Shock, Esq., Chf. Eng. U. S. Navy.

Donations to the Library were received from Hon. Charles Mason, Commissioner of Patents, Washington City, Messrs. Robert C. Walker, A. Pollock, Dr. L. Turnbull, Dr. B. H. Rand, and Robert Riddell, of Philadelphia.

Donations to the Cabinets—Specimens of copper ores, &c., from the Indiana Mine, Daniel Beaser, Esq., Superintendent; also, from the Douglass Houghton, and the Fire Steel Mines, Joseph Coulter, Esq., Agent, Lake Superior; and a specimen of wood bent into a hoop by machinery, from Wm. H. Shock, Esq., Chf. Eng. U. S. Navy.

The periodicals received in exchange for the Journal of the Institute were laid on the table.

The Treasurer's statement of the receipts and payments for September, was read and approved.

The Board of Managers and Standing Committees reported their minutes.

New candidates for membership in the Institute (4) were proposed, and the candidates (3) proposed at the last meeting, were duly elected.

Mr. J. Vaughan Merrick exhibited a specimen of wood, bent in a circular form by the "Ship Timber Bending Machine," presented to the Institute by W. H. Shock, Chf. Eng. U. S. Navy. He stated that this machine was the invention of Mr. Blanchard, well known as the inventor of the gun-stock, and last turning lathes; and that its operation was based on the principle of end pressure, preventing the fibres of the convex side of the wood from extending, and thereby breaking, while the fibres on the concave side, are compressed. He also stated, that the Company, having the sole right to use them, had erected an establishment at Greenpoint, L. I.; that they had two machines now in use, one for ship-timbers, or futtocks, and one for bending frames for furniture, and ships' knees. In the former of these, the timber is bent laterally to the required form, which is taken off the moulding floor, in a flexible frame. It consists of two tables, hinged with each other, and pierced with slots, through which are bolted the dogs, secured to the timber to be bent. The timber, after it has been steamed, being placed against these dogs and upon a band of iron, has end pressure applied to it by a screw. By powerful gearing, the two ends are then drawn around in opposite directions, the iron band retaining the end pressure, while it bends with the timbers. When the required shape is attained, a brace is applied tying together the ends, and it is then removed from the machine, and allowed to harden for some days.

The smaller machine for ships' knees, &c., has a horizontal mandril, carrying a head, oval, circular, or of any other shape to which it is desired to bend the wood; beneath this head, and secured at one end to one side of it, the wood is placed on an iron band, end pressure having previously been applied; the other end of the wood is then secured to the table, on which the wood rests, and the mandril and head being caused to revolve through a portion or the whole of a circle, the bending

is accomplished; the two ends of the curved piece are then connected together, until the fibre of the wood hardens, as in the former case. Mr. Merrick stated that the two objections which had been urged against this plan were, 1st, that the pieces would not retain their shape; 2d, that the strength of the fibre was destroyed by compression so far as regarded a resistance to subsequent extension. That as to the first of these objections, he had seen knees and other curved pieces which had been for some months exposed to the weather, without apparent alteration; and that in regard to the second, time and proper experience were the only tests. He concluded by stating his conviction that the ship-timber bending machine was likely to produce an important effect on ship-building and cabinet-making, so soon as the Company should fully complete their arrangements.

Mr. Merrick also made some remarks upon the late accident to the roof of the new Retort Houses of the Manhattan Gas Company, in New York. This roof consisted of three frames abutting on lines of heavy cast iron gutters, resting upon cast columns; while in process of erection, some weeks since, one of these gutters broke through the caps of the supporting columns, causing its fall, and involving that of the whole roof. From accurate drawings taken upon the spot after the accident, and an examination of the work, it had been found that the gutters, instead of resting in the *whole* of each column cap, as designed, had, by some oversight, been made to bear only on the projecting part of the flanches, which, not being designed for so heavy a strain, gave way when the roofs were but partially slated, involving some loss of life, and great destruction of property. One frame which had not been slated, fell to the ground without injury, while the other two, one of which had been entirely slated, and the other, about three-fourths, suffered severely.

From the designs of the roofs, abundant strength was manifested, but owing to the fact that all the frames were tied together, no part could give way without endangering the safety of the whole.

Dr. Turnbull exhibited to the meeting, specimens of the Natural Printing Process (Naturselbstdruck,) invented by Louis Auer, of the Imperial Printing Office at Vienna. The examples shown consisted of impressions from leaves of trees, several plants, mosses, algæ, lace, and embroideries.

These were all printed in the natural colors of the objects they represented, and were executed in the most delicate and beautiful manner. By many of the members, they were thought to be the objects themselves dried and pasted on the paper. The character of the process was explained by Dr. Turnbull from information obtained from the work of Louis Auer, brought to this country by his learned friend Professor Robley Dunglison, who considers that the process will be of great utility in the studies of the blind.

Query—How can, in a few seconds, and almost without cost, a plate for printing be obtained from an original, bearing a striking resemblance to it in every particular, without the aid of an engraver, designer, &c.?

Solution—If the original be a plant, a flower, or an insect, a texture, or, in short, any lifeless object whatever, it is passed between a copper plate and a lead plate, through two rollers that are closely screwed together. The original, by means of the pressure, leaves its image impressed with all its peculiar delicacies—with its whole surface, as it were—